SCIENTIFIC AMERICAN

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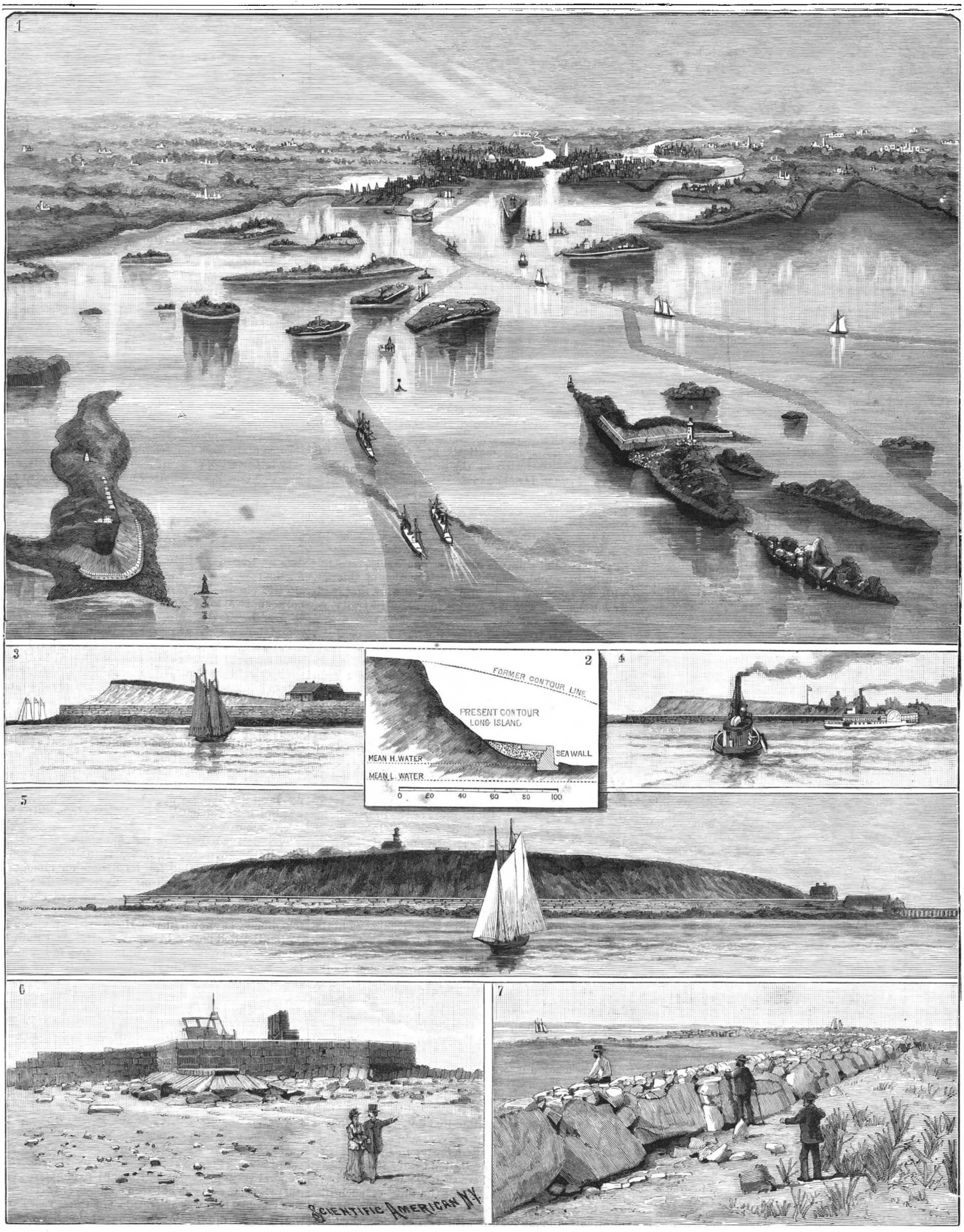

1. Bird's eye view of Boston harbor. 2. Cross section showing retaining wall. 3. Point Allerton. 4. Gallup's Island. 5. Long Island. 6. Sea wall, Lovell's Island. 7. Rubble stone apron, Lovell's Island.

IMPROVEMENTS IN BOSTON HARBOR.—[See page 167.]

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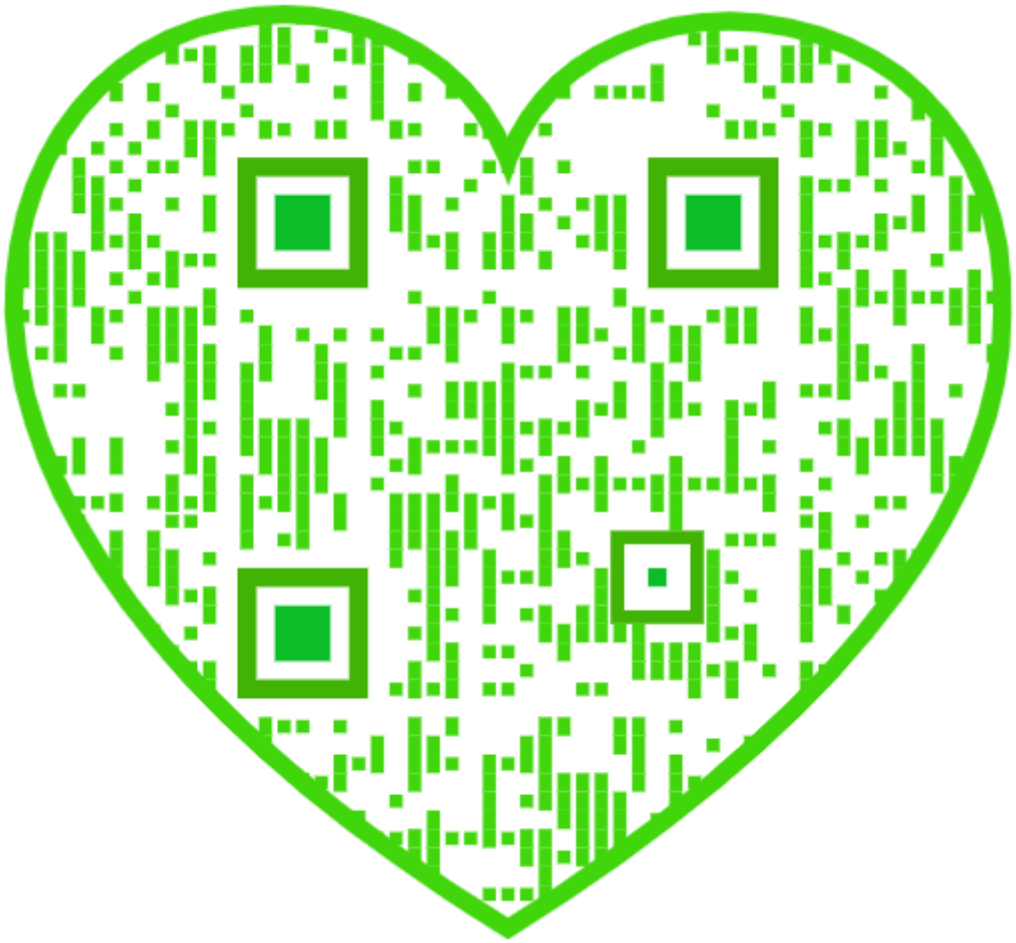

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THE NEW LAW FOR BRAKES AND CAR COUPLERS.

At the recent session of Congress, a law was passed making compulsory the use of brakes controlled by the engineer, and also the use of self-acting couplers. It will be noticed that no special inventions are selected, but the field is left open for the introduction at any time of the latest and best improvements.

In respect to car couplers it may be well for inventors to bear in mind that, while the link and pin variety of couplers has many advocates, especially among the brakemen, who have to handle the cars, still the Master Car Builders' Association advise the throwing out of the link and pins and the substitution of the knuckle form of couplers. The recommendations of the association have made much progress among railway companies, and the knuckle couplers are now extensively used on passenger cars.

The following is the text of the new law.

AN ACT

To promote the safety of employes and travelers upon railroads by compelling common carriers engaged in interstate commerce to equip their cars with automatic couplers and continuous brakes and their locomotives with driving wheel brakes, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled:

Sec. 1. That from and after the first day of January, 1898, it shall be unlawful for any common carrier engaged in interstate commerce by railroad to use on its line any locomotive engine in moving interstate traffic not equipped with a power driving wheel brake and appliances for operating the train brake system, or to run any train in such traffic after said date that has not a sufficient number of cars in it so equipped with power or train brakes that the engineer on the locomotive drawing such train can control its speed without requiring brakemen to use the common hand brake for that purpose.

Sec. 2. That on and after the first day of January, 1898, it shall be unlawful for any such common carrier to haul or permit to be hauled or used on its line any car used in moving interstate traffic not equipped with couplers coupling automatically by impact, and which can be uncoupled without the necessity of men going between the ends of the cars.

Sec. 3. That when any person, firm, company, or corporation engaged in interstate commerce by railroad shall have equipped a sufficient number of its cars so as to comply with the provisions of section one of this act, it may lawfully refuse to receive from connecting lines of road or shippers any cars not equipped sufficiently, in accordance with the first section of this act, with such power or train brakes as will work and readily interchange with the brakes in use on its own cars, as required by this act.

Sec. 4. That from and after the first day of July, 1895, until otherwise ordered by the Interstate Commerce Commission, it shall be unlawful for any railroad company to use any car in interstate commerce that is not provided with secure grab irons or hand holds in the ends and sides of each car for greater security to men in coupling and uncoupling cars.

Sec. 5. That within ninety days from the passage of this act the American Railway Association is authorized hereby to designate to the Interstate Commerce Commission the standard height of drawbars for freight cars, measured perpendicular from the level of the tops of the rails to the centers of the drawbars, for each of the several gauges of railroads in use in the United States, and shall fix a maximum variation from such standard height to be allowed between the drawbars of empty and loaded cars. Upon their determination being certified to the Interstate Commerce Commission, said commission shall at once give notice of the standard fixed upon to all common carriers, owners, or lessees engaged in interstate commerce in the United States by such means as the commission may deem proper. But should said association fail to determine a standard as above provided, it shall be the duty of the Interstate Commerce Commission to do so, before July 1, 1894, and immediately to give notice thereof as aforesaid. And after July 1, 1895, no cars, either loaded or unloaded, shall be used in interstate traffic which do not comply with the standard above provided for.

Sec. 6. That any such common carrier using any locomotive engine, running any train or hauling or permitting to be hauled or used on its line any car in violation of any of the provisions of this act, shall be liable to a penalty of one hundred dollars for each and every such violation, to be recovered in a suit or suits to be brought by the United States district attorney in the district court of the United States having jurisdiction in the locality where such violation shall have been committed, and it shall be the duty of such district attorney to bring such suits upon duly verified information being lodged with him of such violation having occurred. And it shall also be the duty of the Interstate Commerce Commission to lodge with the proper district attorneys information of any such violations as may come to its knowledge: provided, that nothing in this act contained shall apply to trains composed of four-wheel cars or to locomotives used in hauling such trains.

Sec. 7. That the Interstate Commerce Commission may from time to time upon full hearing and for good cause extend the period within which any common carrier shall comply with the provisions of this act.

Sec. 8. That any employe of any such common carrier who may be injured by any locomotive, car or train contrary to the provision of this act shall not be deemed thereby to have assumed the risk thereby occasioned, although continuing in the employment of such carrier after the unlawful use of such locomotive, car or train had been brought to his knowledge.

THE TELEPHONE AND THE BERLINER PATENT.

As the federal administration changes, an interesting legacy to the incoming department of justice is the action commenced by the United States Attorney-General to annul what has become the famous Berliner patent for telephone transmitters. This is the patent issued on November 17, 1891, in pursuance of an application filed on June 4, 1877. A period of fourteen years was consumed in dilatory proceedings. The application was kept pending all this period, while the original Bell telephone patents were protecting the art of telephoning for the benefit of the assignees of the Berliner patent. The fifth claim of the first Bell telephone patent covered the method of transmitting sound by causing electrical undulations similar in form to the vibrations of air accompanying the sound. To this claim the courts awarded the broadest possible scope. The patent now has lapsed. On March 7, 1893, the undulatory current, as it has been called, became public property.

The apparatus for producing the undulatory current is the next question. By the expiration of the original Bell patent, just alluded to, the public acquires the right in general terms to an electro-magnetic telephone. On January 30, 1894, the second of the fundamental Bell patents will expire aud the permanent magnet telephone will be public property. It would seem that the field of telephony should now be open.

In its early days the telephone was recognized as a very imperfect appliance for the transmission of speech. The Bell telephone, whether magnetic or electro-magnetic, acted very imperfectly as a transmitter. It required the use of a loud voice to cause sufficient vibration in the diaphragm to induce operative current changes.

The microphone came next. What the microscope does for the eyes, the microphone in some sense does for the ears. It produces changes of resistance in an electric circuit by varying the closeness of contact between two loosely-touching portions of the circuit. It may be of the simplest description. A couple of round nails may be attached to the ends of a broken circuit, and the interval may be closed by a third nail laid across them. If the nails are subjected to disturbance or agitation of any kind, the resistance at the points of contact will change. Even so simple a contrivance as this constitutes a microphone. It gives no sound. But if in the circuit with it is included a Bell telephone, the latter, by producing sound, responds to every disturbance however slight of the microphone. As a matter of practice, carbon is universally used as one or all of the electrodes or contact surfaces of the microphone. The action of a microphone usually depends on the changes of pressure between the faces of its abutting electrodes. All telephone transmitters are microphones.

The delayed Berliner patent, which will not expire until November 17, 1908, virtually claims any microphone depending for its action on changes of pressure between abutting electrodes. The same thing as far as apparatus is concerned was shown in the Reiss telephones of many years ago. The Bell telephone was shown in the House patent, also antedating the Bell patent by many years. And now the public are to be enjoined from possession of the art of telephony until the next century shall have nearly completed its first decade.

The protection of the last seventeen years has had its effect in building up a powerful corporation. This corporation has introduced most extensive telephone plants in the cities of the United States, and recently has extended its long distance service by the erection of expensive metallic circuits between cities as distant as New York or Boston and Chicago. As its statutory monopoly seemed expiring, the company held a business standing almost as good as a monopoly. But not content with this, the issuing of the Berliner patent has been brought about, which continues their statutory protection for fifteen years more.

In the bill of complaint presented by the Attorney-General very serious allegations are made concerning the proceedings incident to the issuance of this patent. The specification was amended some three years after the date of application by the wholesale process of striking out the entire specification and claims, except the preamble and signature, by striking out all

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the drawings and by substituting new specification, claims and drawings. This proceeding, it will be observed, was done when three years' experience had indicated what the art of telephony really was. The knowledge acquired in those three years had enabled the scope of the Berliner patent to be judiciously expanded. Just at this time an extra anchor seems to have been cast to windward by the securing of a second patent to Berliner on the same drawings for the same apparatus when used as a receiver. How all this is compatible with patent law does not appear.

It has been found that carbon contact microphones are the only practical ones. By an early amendment a carbon contact was introduced as an element of the Berliner invention. This brought about an interference with Edison, which was only dissolved on October 21, 1891, after some thirteen years' pendency. Both Edison's and Berliner's inventions during this period were the property of the American Bell Telephone Co., so that the company was keeping alive proceedings against itself.

The theory of telephony was imperfectly known in the early days when the Berliner patent was being manipulated. But in those times the great preponderance of knowledge was possessed by the telephone company's experts. Therefore they were at a great advantage in dealing with the Patent Office examiner. The government makes a strong point of this fact in its complaint.

It is out of the question for us to present even an outline of the many points brought forward to invalidate the Berliner patent. The above are merely samples. Equity is strongly against it; but the equity of the federal courts has gradually become codified and fixed by precedents until it is nearly as inelastic as law itself. In the past, rival telephone inventors have endeavored to produce make-and-break current telephones so as to escape the fifth claim of the original Bell patent. Hereafter, if the Berliner patent is sustained, the effort must be to produce microphones of unvarying pressure, which will depend on varying area of contact for their action.

A suit to annul the original Bell patent was commenced by the federal government many years ago. This patent has now expired, but the suit is still alive. It is to be sincerely hoped that the suit to annul the Berliner patents will be pushed more energetically, and that the case will be brought to an issue before the patent dies a natural death in 1908.

The World's Columbian Exposition.

SPECIAL NOTES.

It is unfortunate that such a great undertaking as that of preparing the buildings and installing the exhibits at the World's Columbian Exposition cannot be made one of the features of the Exposition itself. It is more inspiring and instructive to see men take swamp and sandy waste and transform it into the present "White City" than to walk through a building filled with set exhibits and not be able to see any of the process of manufacturing or preliminary preparation. This preliminary preparation has been particularly instructive with this exposition, as the swamp has been transformed into lagoons, and the sandy wastes into sward or building sites. In erecting the buildings some foundations were almost literally laid in the mud, yet every building is firm and no trouble whatever has been experienced from settling. The whole seven hundred acres of ground is now fully laid out and only needs the finishing touches of cleaning up, turfing, etc., to make it highly attractive. The whole area has been drained with a complete sewerage system. Water, compressed air and electricity are distributed to all parts of the grounds where needed, so that the "White City" is laid out with the completeness of a city that has required years to develop in.

Still another very instructive feature in the preliminary work is that of the variety of nationalities among the workmen and the characteristics peculiar to each in the manner of doing their work. Englishmen, Frenchmen, Germans, Japanese, Turks, and many other nationalities are busily engaged in preparing their several exhibits.

For months Jackson Park and the Exposition buildings have been referred to as the "White City," and when the Transportation Building was colored a fierce red three months ago a cry of horror was raised. But this cry was uncalled for, as the "White City" will still be practically white when completed. All the buildings will remain as they are now, white, or only a shade or two from it, except the Transportation Building, which is to be painted in the polychromatic style, but which will be very light in effect. On the exterior of this building winged figures are to be stenciled on the panels which alternate with the flag staffs, while all the flat surfaces are to be quite elaborately decorated, one of the patterns being composed of conventional thistles and foliated designs. All the color effect within the grounds will be given by flags, bunting, awnings and hangings. Large awnings of bright colors will be on the roof of the Woman's Building, over the golden entrance to the Transportation Building, and on many balconies and on other buildings.

The stability of the covering to the buildings—staff—has had a thorough test with the long cold winter, and the material has proved all that could have been asked for. The staff used in covering and decorating the Exposition buildings is composed of plaster of Paris and fiber, "New Zealand hemp" being used mostly. Each piece of staff is cast in a mould. If it is a plain flat surface, the mould is simply a box; but if the staff is ornamental the mould is of gelatin, so as to have elasticity. The process of making it is simple. A coating of plaster is thrown over the face of the mould to the depth of about an eighth of an inch, to give a smooth, clear surface. The fiber is then beaten until it is in a feathery condition, dipped in liquid plaster, and pressed into the mould. When hardened, the staff stands considerable hard usage, and the slabs can be nailed in place like so many boards. In every instance where the laying has been properly done the staff has not been appreciably affected by the long, hard winter. In a few isolated instances flat surfaces have cracked off; but this is only where water has found its way in. The lagoons are mostly walled in by what appear to be marble walls. These are simply wooden surfaces covered with staff; but in preparing the material for this use it is composed of one-fourth of best Portland cement. When the staff work is pointed up and given a coating of paint, it will not absorb moisture.

Some weeks ago it was announced that the Vanderbilt family had leased one of the largest and most commodious mansions on Michigan Avenue for the six months of the World's Fair for $20,000. But this is only one of many similar leases. Another Michigan Avenue house has just been leased for four months at $4,500 a month to a prominent New Yorker, while a well known Philadelphian has leased a commodious Prairie Avenue house for six months at $3,000 a month. The highest price yet offered for a residence has been $50,000 for the season of the Fair for the palatial residence of a Chicago millionaire, which has been only recently occupied. The offer was made by a Philadelphia street railway magnate. Inquiry at the leading renting agencies by your correspondent reveals the fact that forty or more leases have already been made of private houses in Chicago in which each lease has been for $1,000 a month or over. Many negotiations are now being carried on, and from present indications it would not be surprising if there were as many more leases made before May 1 of equal value. The number of leases of smalleramounts are quite without number, and include some of the best known names in the country in social, political, and financial circles. Many choice suites at the leading hotels have also been arranged for by well known people. The people to whom price is a minor consideration have very generally engaged accommodations ahead.

With the disappearing of the snow the working forces at the Exposition are increased; over six thousand men are now employed. Over five hundred car loads of exhibits have arrived, and the arranging and installing of these requires the services of many men, but in a week or two the daily arrival of exhibits should be about five hundred car loads a day, as it is estimated that there will be all told over twenty-five thousand car loads. A great demand for men as soon as the snow and ice are gone will be in clearing up and completing the work of beautifying the grounds. The work of hardening the paths was scarcely more than begun when the cold weather interfered. Then debris as a result of pushing building operations with such vigor is scattered everywhere, and it will take several thousand men two or three weeks at least to clear away this. When the grounds are once cleaned they are to be kept so with much care, and during the holding of the Exposition it is proposed to have them cleaned from one end to the other every day. This work in itself will require a large number of men, as there are seven hundred acres inclosed in the park, and a few evenings each week the grounds will be open to the public until ten o'clock.

Work is being pushed in all parts of the Exposition with restless energy. The weather has hampered progress in every way, but work has gone on in spite of it. The great passenger station has been completed during all the cold weather, and will be ready for trains on May 1 without difficulty. In all the buildings as many men are given employment as the amount of work will warrant. Foreign exhibitors are, as a rule, much more prompt than those of this country. The Palace of Mechanic Arts is particularly interesting just now with the work of installing such a vast amount of machinery. The temporary power plant, which has been in service from the first, can be used only until the 15th inst., so work is being pushed with special reference to putting part of the permanent plant into operation on that date. There are already about a dozen engines of the fifty or more to be installed on their foundations, and several batteries of boilers are ready for firing. The plant for handling the fuel oil is ready for use, and only waiting for the Standard Oil Company to turn the oil into the tanks, as the pipe line connections are already made. The Westinghouse 4,000 light alternating dynamos are connected and ready for operation, and the work of putting two of the large dynamos, with a maximum capacity of 15,000 lights, is well under way. Parts of these enormous machines are scattered about the building and attract much attention from electrical men. The gallery in which is to be the switchboard for the incandescent plant is well on toward completion. In the center of the building the pit has been cemented preparatory to installing the fountain. An interesting sight in the Transportation Building is the little Pioneer, the first locomotive which ran out of Chicago, a mere speck of a machine, while a little distance away Englishmen are erecting a monster locomotive built years ago for a seven-foot gauge, the Lord of the Isles.

The foundations for the two electric fountains at the head of the basin have been put in under much difficulty, as the work has all been done during the cold weather, but the General Electric Company, which has a contract for constructing the fountains, has had a large force of men at work, and the superstructures are now being placed in position.

Work on the boiler plant has been much hampered by legal complications between two safety boiler companies, one of which claimed to hold a concession granting it the privilege to install all the boilers. After litigation for two months the courts have decided against this special concession. The day following the decision, workmen were on hand clearing away the ground ready for installing enough boilers to fill the main boiler house. Contracts have just been made for several hundred horse power to be installed in the boiler house annex.

The annual election of officers of the World's Columbian Exposition takes place April 1, and for weeks past a number of men who are anxious to help carry some of the honors that will go with an official position during the holding of the Exposition have been soliciting proxies, and in several instances buying up stock. But the present management has carried on the work so efficiently and with such evident satisfaction that there is little probability of any official being unwillingly retired. It is understood that more proxies than enough to re-elect the present board of directors have already been offered them unsolicited.

The last building to be contracted for is the Bureau of Public Comfort, which is to cost $28,000. Although the contract was let only three weeks ago, the framework of the first story is nearly completed.

President Cleveland has been officially invited to be in Chicago on May 1, and open the Exposition to the public, and start the machinery.

Plans were partially perfected to install a complete still in miniature in the agricultural section for the manufacture of whisky, but the internal revenue officers were so strict in their requirements that this exhibit may be dispensed with.

Director-General Davis has issued an order calling upon all exhibitors to give definite information immediately as to their intentions in all detail. Not only must the work of installation be begun at once, but notice must also be given by those who wish electricity for purposes of lighting or power, or who want telephone or other services.

During the recent cold weather the trusses of the Manufactures and Arts Building are understood to have contracted five inches. In midsummer it is estimated that the building will expand to be about a foot wider than it is now.

Mr. Frederick Sargent, who has been engineer of the combined mechanical and electrical department, has been made general manager of the department, and his assistant engineers promoted, thus relieving him of much of the detail work of the department.

About the middle of February it was announced through the daily press that a large number of young men would be able to find service under the Exposition, either in the Columbian guards or as guides, and that college students would be given the preference. In two weeks a thousand applications for positions as guides were received. Only one hundred or two hundred men at the outside will be required for this service, but applications still continue to come in.

A post office has been established in the Administration Building for the convenience of Exposition employes, and a sub-station will probably be established just outside the grounds for convenience of visitors during the holding of the Fair.

The foundation is being put in for the Ferris wheel. This wheel is to be 264 feet in diameter, with 36 cars, each as large or larger than a Pullman, attached to the circumference, and swinging from it.

A SUCCESSFUL test of a Harveyized steel armor plate was recently carried out at the Indian Head proving grounds. The object of the test was to determine the trial of the plates representing 2,000 tons of armor for which bids have recently been received by the Navy Department. A 10 inch gun was used, placed at about 30 feet from the plate. In three successive shots the velocity was increased from 1,472 feet to 2,060 feet. The last shot penetrated deeply, but the excellent quality of the armor was fully demonstrated.

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AN INEXPENSIVE WINDOW AWNING.

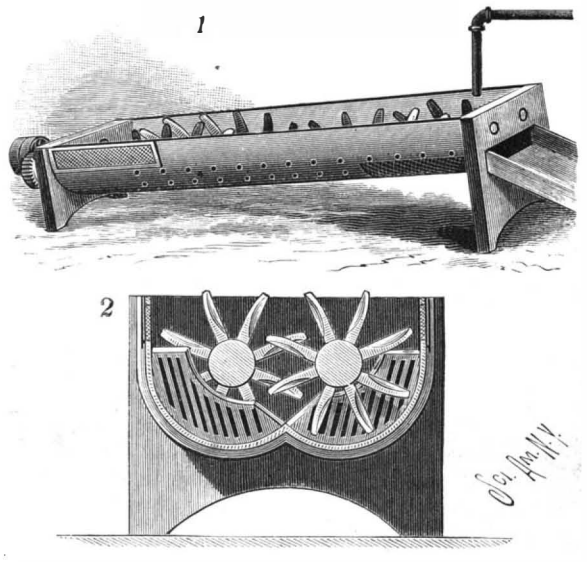
An improvement whereby the ordinary window shade may be used as a part of a window awning, serving when not so employed the ordinary purposes of a window shade, is illustrated in the accompanying engraving, and forms the subject of a patent which has been issued to Mr. Bernard Branner, of New York City. The ordinary spring roller shade, E, is shown extended outwardly as an awning, in which position it is supported by a keeper hook at each side in the outer ends of the stretcher rods, C, of the side wings, D. These stretcher rods are

BRANNER'S WINDOW SHADE AWNING.

each hinged on the lower end of an upright stay rod, secured one on each side of the window, the stay rods forming the upright supports for the wings, whose lower edges are connected with the horizontal stretcher rods. A cord, A, is passed through marginal rings in the wings, and by drawing on this cord the stretcher rods are folded upwardly, inclosing the attached wing material, a cord, B, facilitating the extension and securing of the awning in position. Different forms of side stay rods are contemplated by the invention, and the wings and their stretcher rods may readily be completely removed. When the shade is not to be used as an awning, it is released from the keeper hooks on the outer ends of the stretcher rods and drawn into the apartment, then becoming a pendent screen for the window. By a slight change in the location of the awning material the device may also be utilized as a screen for a door.

AN IMPROVED PHOSPHATE WASHER.

A simple device for separating sand, clay, marl or other substance from the phosphates, at the same time preventing the balling of the clay or marl, is shown in the illustration, and has been patented by Mr. William A. Beaty, of Plant City, Fla. The washer is represented in perspective in Fig. 1, and, as shown in transverse section in Fig. 2, the trough consists of two longitudinal sections, connected with each other in the middle to form a longitudinal ridge. In the two sections are transverse partitions, set to form alternating pockets, each of the partitions being perforated by slots. Through the pockets pass agitating arms set spirally and radially on shafts journaled in the legs of the trough, the outer ends of the shafts being connected with each other by gear wheels, and one of the shafts being connected with a source of power. The lower end of the trough is closed, except that it has side sections covered by wire netting, permitting the discharge of muddy water at this, the feed end of the machine. There are also perforations in the sides of the trough leading to the pockets, permitting the discharge of fine sand, clay or other refuse, and near the upper or discharge end of the trough are wire screen sections, over which the phosphate is passed to the discharge chute, the remainder of the sand, clay and marl, etc., being separated from the phosphate by the screens. Water flows constantly into the open upper end of the trough from a suitable supply pipe, meeting and thoroughly washing the material as it is fed forward by the rotating arms, the material being moved first from one pocket of one section to the alternating pocket of the other section, then back to the next forwardly alternating pocket of the first section, and so on until the refuse and the phosphates are completely separated by the time the latter are passed out of the open upper end of the trough.



BEATY'S PHOSPHATE WASHER.

BRIDGES ON THE TRANSANDINE RAILWAY.

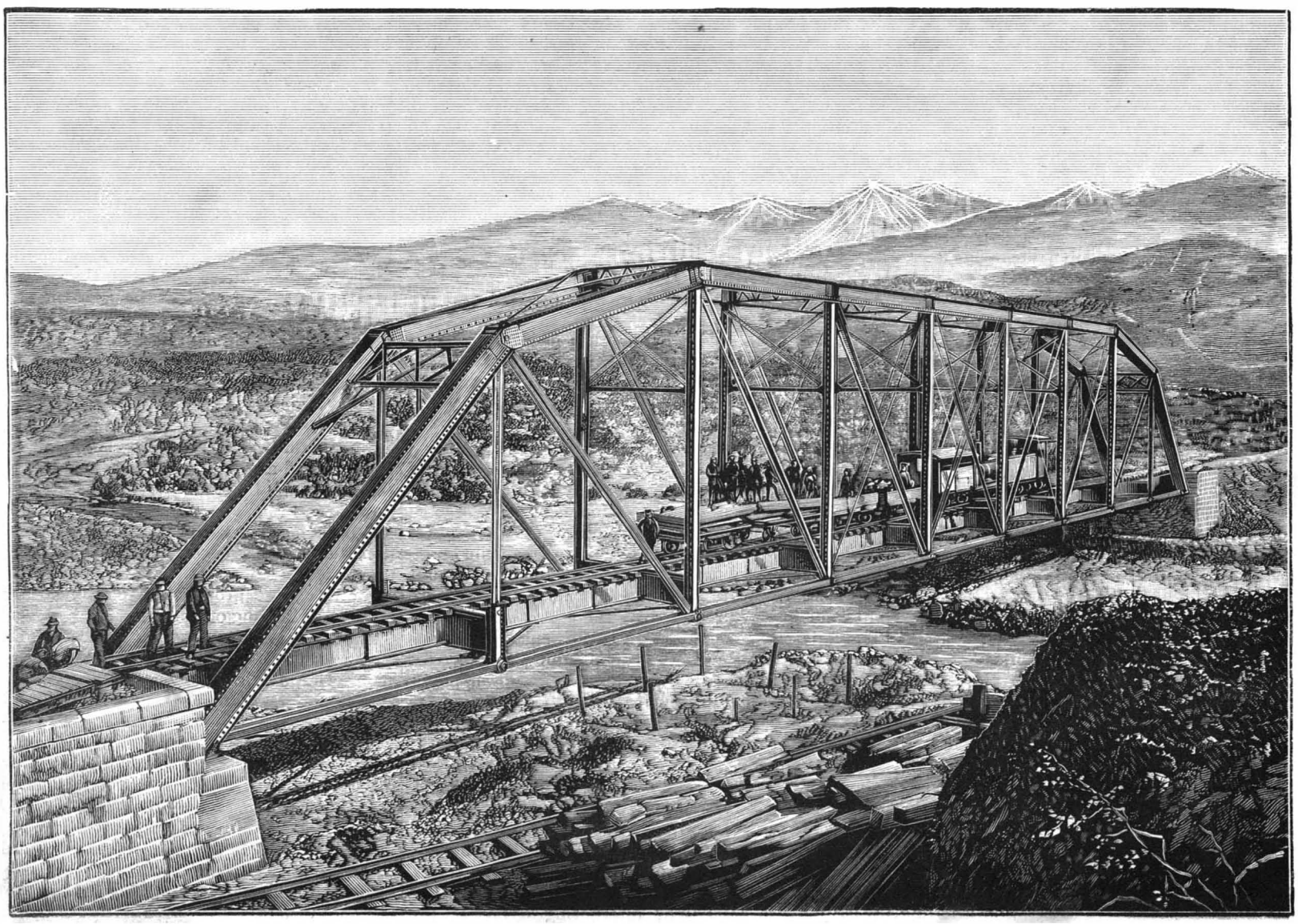
Of the new railway which completes the system across South America over the Andes range of mountains, connecting Buenos Ayres with Valparaiso, in Chile, 106 miles can now be traversed by trains, so that only 42 miles of the distance have to be traversed in carriages or on mules. These 42 miles involve the very laborious works of constructing the tunnels through the highest peaks of the Andes mountains. When completed the traveler will be able to cross the continent from shore to shore by railway in about 60 hours, whereas, by sea, round Cape Horn, the time taken is 12 days.

In the 109 miles of railway there are about sixty bridges and culverts, varying in span up to 246 feet. We give an engraving of the largest bridge, of 246 feet span. The larger bridges are of American construction. The reason for this is certainly interesting, as it raises an important point on the relative value of American and British bridge building practice, and shows how that practice operates in the matter of securing foreign orders, or orders for foreign countries, which is not quite the same. Time was an important element in the matter; the railway was practically completed, but could not be opened until the bridges were constructed and in position. Several British bridge builders were therefore asked to state the time they would require to build a bridge of 246 feet span, and the shortest time asked was eight months. A cablegram to one or two American firms brought the reply from two that they would deliver all the four bridges of the size required alongside a vessel at New York in eight weeks, while a third asked twelve weeks. There was no alternative. Cables were again sent to the three firms stating the load and the tests to be made when the bridge was in position, and offers were at once sent. The span we have given; the tensile strength of the steel used was to be from 26 to 30 English tons to the square inch, with an elongation of 20 per cent in 8 inches before fracture. The builders were to guarantee that the bridges satisfied the test requirements when in position. The main girders were to be 15 feet 1 inch between centers, to carry the single line of meter gauge (3 feet 3⅜ inches). Here are the offers:

Tenders for Bridge of one Span, 246 Feet.

Name.	Price. £	Weight. Tons.	Price per Ton. £ s. d.	Delivery. Weeks.
Union Bridge Company, U. S.....	2,515	156	16 2 0	12
Phœnix " " "	2,637	156	16 17 8	8
Edgmoor " " "	2,493	164	15 3 5	8

Time, as we have said, was the consideration, and



THE 246 FOOT SPAN AMERICAN BRIDGE ON THE TRANSANDINE RAILWAY.

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weight was an important element in view of the distance the bridge had to be conveyed inland, so that the Phœnix Company got the order, although their price was highest. It is interesting to note that the changing of the material from iron to steel only involved an increase of 5 per cent, the tests being as above, and it is further noteworthy that the Phœnix Company wished the truss to be 35 feet deep, and offered to make the price less with it than with a 32 foot truss.

The point suggests itself: How could the American firms offer to build the bridge in as few weeks as the English firm required months? The reply is simply hat their sys tem of bridge building enabled it to be done. Here the builder gets his drawings from the railway engineer, who designs every rivet and bolt, if he does not specify how the rivet or bolt is to be driven. A. B. wishes one style, C. D. an entirely different type, so that the builder must be prepared for anything—the advocates of the American system might say for nothing. In America, on the other hand, the builder designs the bridge, or rather he has a standard type, and the engineer only needs to state requirements. The firm can therefore have special machinery for rolling their iron or steel to the standard sections needed, and are thus independent of steel makers. They are, therefore, prepared in the fullest sense of the word. It may be urged that the British system admits of greater choice of design, and therefore suits British needs; but after all it is to the foreigner we, in large measure, have to look for orders, and as a rule he is satisfied with what he can get quickly and cheaply, provided it meets the desired conditions as to load and tension and compression tests. We do not enter into the relative value of American and English designs, or as to whether American or British prices are lowest. Our contention is that there are most convincing evidences that the American practice has its advantages. As to relative prices, it is to be regretted that in the case of the 246 foot span quotations were not got from English as well as American firms; but Messrs. Clark's business was not to collect proofs on economic points. Fortunately, however, the idea suggested itself, presumably for other reasons, to get an English firm to quote a price for a 197 foot span from sketch drawings supplied by an American firm who had tendered, so that we have in this case comparative prices:

Quotations for 197 *Foot Span.*

	Price. £ s. d.	Weight. Tons	Price per Ton. £ s. d.
Pencoyd Bridge Company, America	1,679 13 0	117¾	14 5 0
British firm	2,025 3 0	138	14 13 6

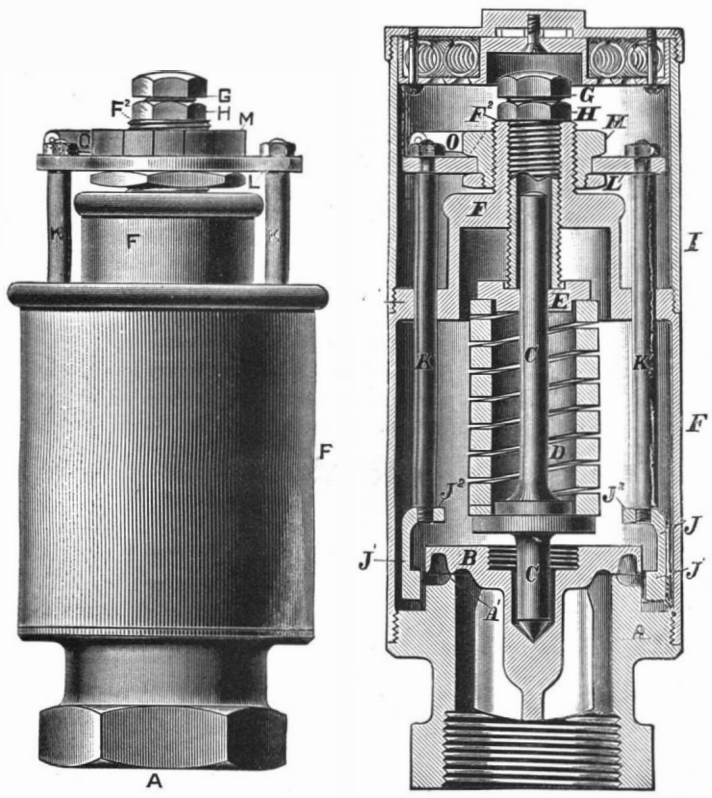
It will be noticed that the British firm (which need not be named) assumed a greater weight—that is in accordance with practice—and that their price per ton was greater, notwithstanding that material and wages are said to be dearer in the States. Of course the American firm have special machinery. This, however, one may find in almost all concerns.

We are indebted to *Engineering*, London, for our engraving and the above particulars.

A SLIGHT earthquake shock was experienced in the northern part of New York City and Long Island City, N. Y., on March 8, at 12:40 A. M. The shock lasted thirty-two seconds, and was accompanied by rumbling noises, oscillations from east to west.

AMERICAN IMPROVED LOCOMOTIVE VALVE.

The accompanying cuts show two forms of locomotive valves, one with muffler and one without muffler, which were designed and patented by A. P. Kinney, superintendent of the American Steam Gauge Co., of Boston. The superiority of this locomotive valve lies in the fact that it can be adjusted on top without removal from the dome of the locomotive. In order to adjust either the pressure or the blowdown, first remove the muffler, I; this exposes the compression screw, G, adjustable nut, M, crosshead, L, locking latch, O, and check nut, H. By loosening the check nut, H, and screwing down the compression screw, G, the pressure is increased, and the reverse for lessening the pressure. As a general rule, from 1-6 to ¼ turn will change the pressure of the valve five pounds either way. By raising the locking latch, O, and screwing down on the adjusting nut, M, one notch, you reduce the blowdown one pound, and the reverse increases it one pound.



OUTSIDE VIEW WITHOUT MUFFLER. INSIDE VIEW WITH MUFFLER.

THE KINNEY LOCOMOTIVE VALVE.

Until the present styles of locomotive valves were placed on the market by this company, in order to adjust the blowdown, the valve had to be taken from the dome of the locomotive. It was also impossible to adjust while steam was on. The present styles do away with these objections and are a great advance over anything hitherto produced.

Although lately placed on the market, a number are in use on the largest railroads of the country. These are giving excellent satisfaction, and additional orders from the companies using them are the best evidence that a trial is all that is needed to secure their adoption.

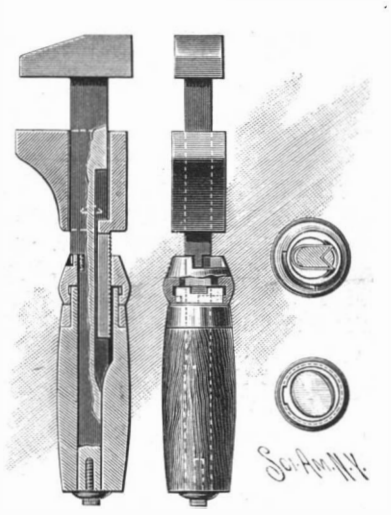
The American Steam Gauge Company, 34 Chardon Street, Boston, who are the sole manufacturers, will be pleased to furnish additional information to any one making application.

A LOCOMOTIVE STONE BREAKER.

With the improved means of stone ballasting a railway track shown in the illustration, nothing but clean stone, substantially free from dust, and with no admixture of soil, is placed upon the roadbed. The improvement forms the subject of two patents issued to Mr. A. B. Austin, of Fort Wayne, Ind., the machine being in the form of a locomotive adapted to run thirty miles an hour, while it can be changed to a stone breaker in five seconds, by raising the drivers off the track. The machine is always ready for use, on the road or in the quarry, and will break from twenty-five to thirty cubic yards of stone per hour, while it will also haul one loaded car. The rock for ballasting can be handled in large lumps, being loaded on flat cars and drawn to the place of use, two-thirds of the rock being undisturbed as it is dropped from the car on to the roadbed, thus saving the handling of the ballast by shovels. The distance between the crushing jaws and the size of the crushed material is regulated by raising or lowering wedges by means of a rod and nut. The material is crushed by the machine to a more uniform size and in a more expeditious manner than the same can be effected by hand for a macadam or an ordinary roadway, as well as for a railroad, and is delivered with great facility at any desired point, its means of self-propulsion enabling it to be moved at a minimum of cost, and saving expense of handling.

AN IMPROVED WRENCH.

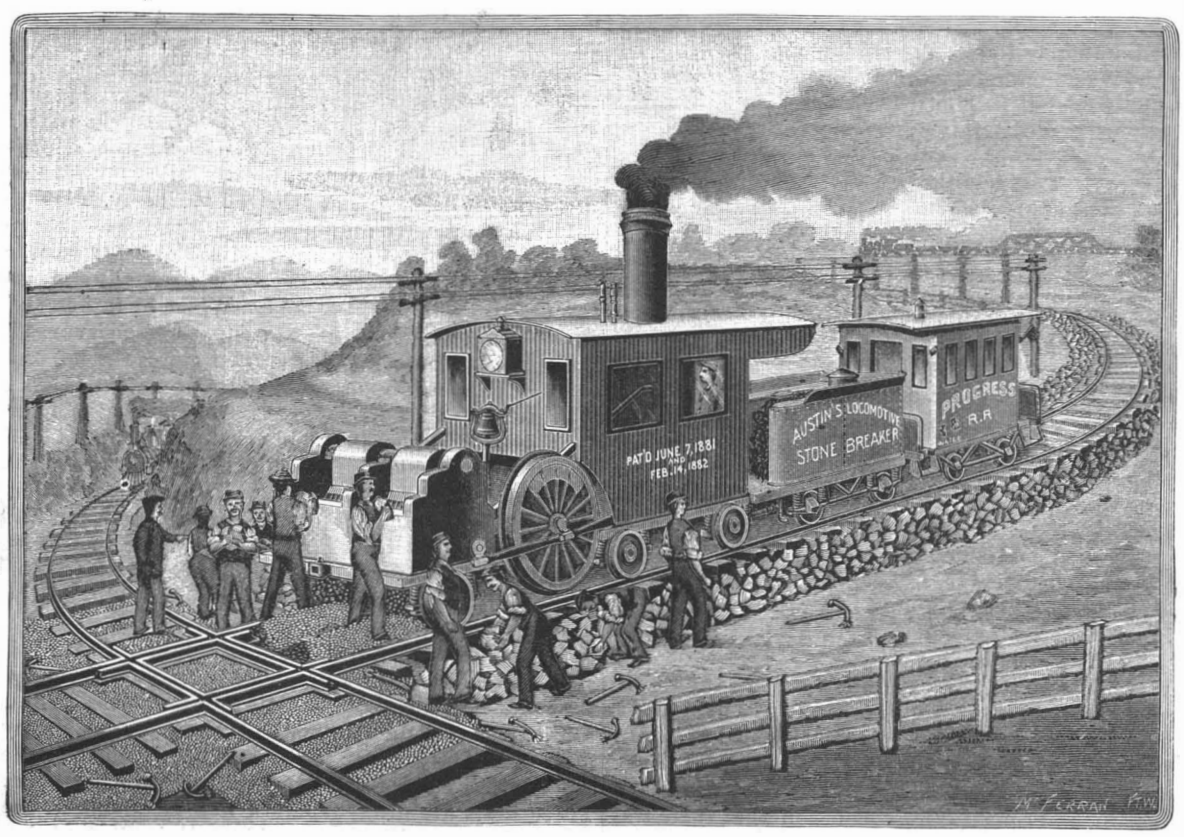
In this simple and durable wrench, which has been patented by Mr. William H. Kaltenbeck, the lower jaw may be made to slide up or down upon the shank of the body bar, and be locked at any desired position thereon, by means of an easily manipulated lock nut or sleeve. The small figures show different sections of the locking nut or sleeve, a cross section of the body bar for a portion of its length, as shown in one of these figures, having its forward edge cylindrical and threaded, while in its rear edge is a V-shaped groove, in which fits an arm or socket extension integral with the lower or movable jaw of the wrench, the exterior surface of the extension being cylindrical and provided with a thread. The locking nut or sleeve is swiveled upon the upper end of the handle, from which it is readily detachable, and this nut is made in two diameters, one greater than the other; at the lower diameter the inner contour is circular and at the upper diameter it is somewhat elliptical, the opposite side walls of the smaller diameter of the nut having threads. To adjust the lower jaw to or from the upper one, a turn of the sleeve or nut permits the lower jaw to be moved freely upon the body bar, and when the jaw has been properly placed the sleeve is turned in the opposite direction, when its threads engage the threaded surfaces of the body bar and the socket extension of the movable jaw, firmly locking the latter in the desired position. The jaws of the wrench may be shaped for use either as a monkey wrench or as a pipe wrench.



KALTENBECK'S WRENCH.

Further information relative to this improvement may be obtained of Mr. W. F. Baker, Middlesborough, Ky.

Electricity is our authority that an electric railroad from Main Street, Orange, N. J., to Montclair, with a branch running from West Orange to Eagle Rock, is to be built as soon as the weather will permit the work to be done. The terminus at Montclair will be at the Delaware, Lackawanna and Western Railroad station.



AUSTIN'S LOCOMOTIVE BALLAST CRUSHING MACHINE.

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Snow Plows Needed in Roumania—A Chance for American Inventors.

We take pleasure in publishing the following letter from Mr. Ch. Courgoulier, 60 Calea Victoriei, Bucharest, Roumania. The communication speaks for itself:

"Every year the snow stops the movement of trains in Roumania for a longer or shorter time. This year they were obstructed for more than three weeks. Having learned through *La Nature* and *La Revue Generale des Chemins de Fer* that rotary plows are used successfully on the lines of the United States, it occurred to me that I would propose a trial of them on the lines of Roumania. My proposition was accepted. So I write to ask you to give me assistance in carrying out my idea, by furnishing me with all the necessary information for the introduction of one of your plows into Roumania, and making experiments with it. If it works successfully, others will be needed.

"I will need to have drawings and detailed description of these plows, and the results obtained by experience. Also dimensions, weight, price, terms of payment, time required to deliver, expense of transportation, supposing that the apparatus can be delivered on a boat at Galatz, a port on the Danube."

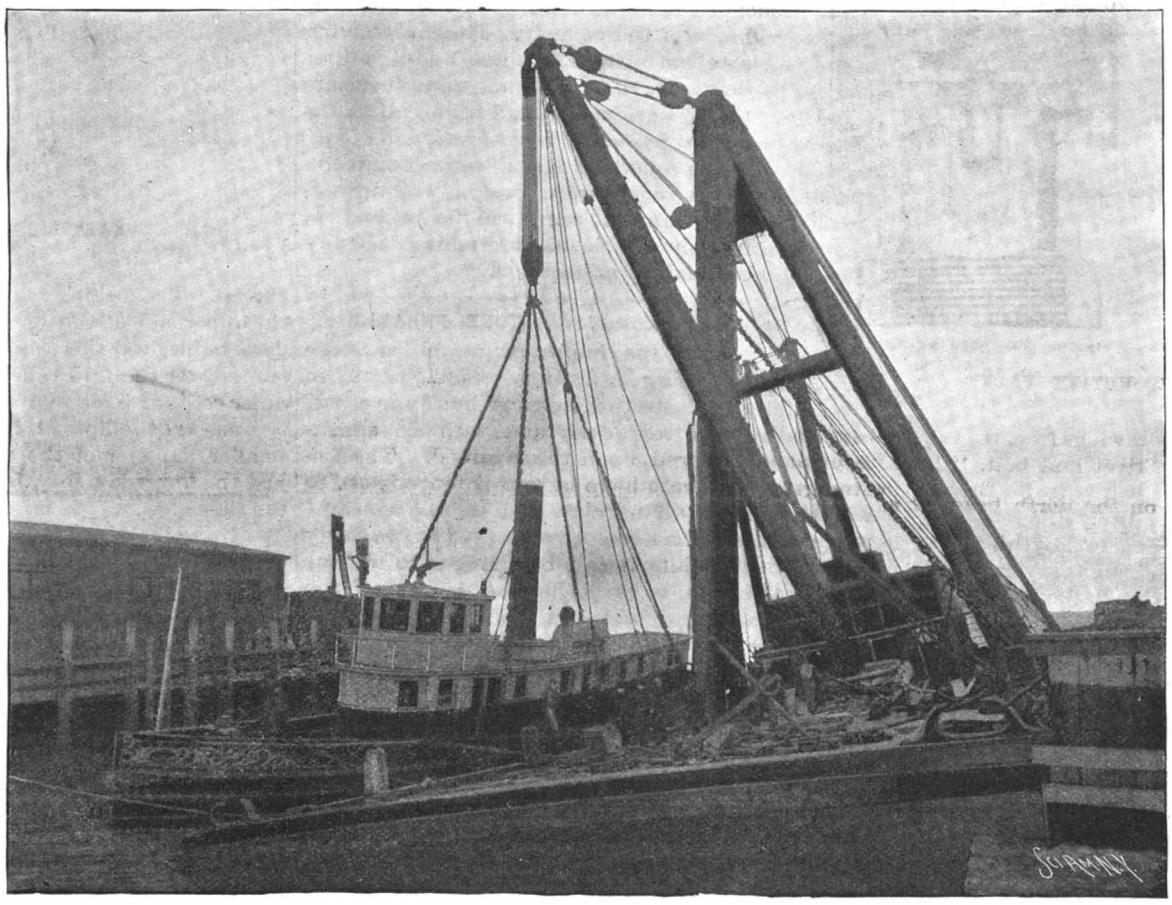
We trust that numerous responses will be received by Mr. Courgoulier. Write him direct.

HOW SUNKEN VESSELS ARE RAISED.

On the morning of February 27 the United States revenue cutter Washington, Lieut. C. F. Shoemaker, U. S. R. M., was run down by the Brooklyn Annex boat No. 3, of the Pennsylvania Railroad Company, just opposite the Barge Office dock, at the southern extremity of this city, where the East and North Rivers unite. The cutter's port side was stove in amidships, and the vessel sank just inside her slip at the Barge Office.

The Custom House authorities appropriated $500 to have her immediately raised, and the Chapman Derrick and Wrecking Co. began the work of raising her at 7 P. M. Feb. 28. The derrick boat Reliance was employed. With the aid of divers a sling of chains was passed under the boat and attached to the arm of the derrick, as shown in our photograph. The steam hoisting gear of the derrick was then set in motion, and at once the sunken vessel began to rise out of the water. The Washington was soon completely raised. The derrick and her burden were then towed to dock for repairs.

The Chapman derrick consists of a strong float or scow provided with several watertight compartments, on which a powerful crane is erected, worked by steam power. The machine is capable of lifting weights of several hundred tons. The raising of a sunken boat like the Washington is considered a small affair for this machine to handle. This derrick was fully illustrated in the SCIENTIFIC AMERICAN of November 8, 1890.



RAISING A SUNKEN REVENUE CUTTER.

The Sources of the Nile.

The report of Dr. Baumann's latest geographical investigation of the Kagera River and the country lying between that stream and Lake Tanganyika affords an interesting and important contribution to the history of the sources of the Nile and a singular confirmation of the ancient myths concerning the Mountains of the Moon.

On September 5 last Dr. Baumann's expedition, after having crossed Stanley's route a week previously, reached the Kagera River, and was received by the natives of Urundi with such demonstrations of joy and respect that he instituted inquiries as to the cause of their enthusiasm. He learnt that Urundi, from Ujiji to Rouanda, had been for ages ruled by kings who were supposed to be lineal descendants of the moon, and that the natives believed him to be the last king, who had died a generation before and who had now come back to them from the moon.

On September 11 the expedition crossed the Akenyaru, which is not, as supposed, a lake, but a river, though the name "Nyanza" is often applied to it. Dr. Baumann also discovered that the so-called Lake Mworengo is in reality a river which flows into the Akenyaru, and came to the conclusion that there was no extensive sheet of water in Ruanda or North Urundi. On September 19 Dr. Baumann arrived at the source of the Kagera, which rises at the foot of the precipitous and wooded hills which form the watershed between the basins of the Rufizi and the Kagera. This mountain chain is known to the natives by the name of the "Mountains of the Moon," and is held in peculiar reverence by them. Here Dr. Baumann maintains the real source of the Nile to be, for if "it be acknowledged that the Kagera is the chief feeder of the Victoria Nyanza, it follows that the headwaters of the Nile can be none other than those of the Kagera itself in the Mountains of the Moon in Urundi, within the boundaries of German East Africa."

The Trap Door Spider.

Mr. D. Cleveland, of San Diego, Cal., contributes to *Science* an article in which he states some curious facts regarding the trap door spider (*Mygale henzii*, Girard), which is widely diffused in California. Behind San Diego there are many hillocks about a foot in height and three or four feet in diameter. These hillocks are selected by the spiders, Mr. Cleveland suggests, because they afford excellent drainage and cannot be washed away by the winter rains. A suitable spot, which always consists of clay, adobe, or stiff soil, having been chosen, the spider excavates a shaft varying from five to twelve inches in depth, and from one-half to one and a half inches in diameter. This is done by means of the sharp horns at the end of the spider's mandibles, which are its pick and shovel and mining tools. The earth is held between the mandibles and carried to the surface. When the shaft is of the required size, the spider smooths and glazes the wall with a fluid which is secreted by itself. Then the whole shaft is covered with a silken paper lining, spun from the animal's spinnarets. The door at the top of the shaft is made of several alternate layers of silk and earth, and is supplied with an elastic and ingenious hinge, and fits closely in a groove around the rim of the tube. This door simulates the surface on which it lies, and is distinguishable from it only by a careful scrutiny. The spider even glues earth and bits of small plants on the upper side of the trap door, thus making it closely resemble the surrounding surface. The spider generally stations itself at the bottom of the tube. When, by tapping on the door, or by other means, a gentle vibration is caused, the spider runs to the top of its nest, raises the lid, and looks out and reconnoiters. If a small creature is seen, it is seized and devoured. If the invader is more formidable, the door is quickly closed, seized, and held down by the spider, so that much force is required to open it. Then the spider drops to the bottom of the shaft. When the door of the nest is removed, the spider can renew it five times—never more than that. From forty to fifty cream-colored spiderlings are hatched from the yellow eggs at the bottom of the nest.

When these have attained only a fraction of their full size—before they are half grown—the mother drives them out into the world to shift for themselves. After a brief period of uncertainty they begin active life by making nests, each for itself, generally close to "the old homestead," sometimes within a few inches of it. These nests are always shallow and slender, and are soon outgrown. When the spider attains its full size, it constructs a larger nest.

Sparking of Dynamo Brushes.

The *Elektrotechniker*, of Vienna, contains some useful remarks on this subject which, we feel sure, will prove of interest to our readers. The sparking of dynamo brushes not only wastes the brushes and the commutator prematurely, but also gives rise to a considerable loss of energy, which might otherwise be properly utilized. This sparking formerly was one of the unavoidable defects of dynamos, while nowadays the commutators of small machines mostly run without sparking—provided no mistakes have been made in the construction and treatment of the machine—and the sparking of large machines has been reduced to a minimum.

The sparking may be due to various causes. It occurs when the armature becomes strongly heated, and is due to a faulty construction of the latter. If the pieces of sheet iron of the armature are not properly insulated from one another, Foucault currents are set up in the iron and strongly heat it. The armature, therefore, is tested, before being wound, by making it rotate for several hours between strong magnets. If it has been properly constructed, the increase of temperature will be very slight. The armature may also be heated by too heavy a load. This will occur when more lamps are switched on than the machine ought to feed. For regular working the armature wire must not be loaded with more than 4½ amperes per square millimeter (0·00155 square inch). Some manufacturers go as high as 6·4 amperes per square millimeter, but this is a very questionable practice. The E.M.F., too, must only be allowed to rise within certain limits, which are generally specified by the manufacturer for each machine. If the E.M.F. at constant current is unduly raised, a much larger number of revolutions is required, the armature iron is heated by the frequent changes of polarity, and the shaft runs hot in the bearings. Sparking also occurs when the brushes do not lie against the neutral points of the commutator. These neutral points, in consequence of the reaction of the armature current on the field magnets, are subject to displacement in the direction of rotation of the armature when the current increases, and in an opposite direction when the current decreases. When the brushes touch at the same time two segments of the commutator, the latter are short-circuited; this causes an overload of the respective convolutions of wire and gives rise to sparking. The commutator must not be rough or uneven, and must have no protruding sheets. By protracted use the sheets of the commutator are ground by the pressure of the brushes, and in this case the commutator must be turned off, or new sheets must be inserted.

Sometimes, during the rotation of the armature, a sudden flaring up is noticed at the commutator; this is frequently due to interruptions in the armature winding. A break of current in the field magnets can also give rise to strong sparking. In the present state of perfection to which dynamos have been brought the sparking of the brushes can be altogether avoided, or, in large machines, reduced to a minimum. In every case the constructor can ascertain and remove the cause of this defect.—*Electricity, London.*

A Varnish for Collodion Lantern Slides.

A correspondent writes: I have been making a series of experiments to find out the best varnish for collodion lantern slides. I have tried nearly all the published formulæ, including Mr. Armstrong's acetic solution of gelatine, but the best one which I have used is as follows:

Tunny's impervious varnish (This is a saturated solution of amber in chloroform.)	1½ ounces.
Pure benzol	1½ "
Gum dammar	¾ ounce.

When dissolved to be filtered through cotton wool.

This varnish runs on the plate as freely as collodion does, without the tendency to coat your fingers and backs of the plates like most other varnishes which I have tried. It dries hard with a gentle heat, and is not tacky, and it renders the film quite bright and glass-like.—*Br. Jour.*

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IMPROVEMENTS IN BOSTON HARBOR.

On our front page we give a bird's eye view of Boston Harbor, showing the different channels which have been widened and dredged by the United States government, and some of the numerous islands which dot the harbor, showing also more in detail some points where the more important work has been done by the United States corps of engineers.

The objects of these improvements, which were commenced in 1825, is first to preserve the harbor by protecting the islands and headlands, and second to improve it by widening, deepening and straightening the channels.

The projects adopted for this purpose since 1866 have been mainly in accordance with the recommendations of the United States commissioners, whose labors terminated during that year.

The works of preservation consist of sea walls, aprons, jetties, etc., which protect the shores of the islands and headlands, prevent additional wash into channels, control the tidal scour, and preserve the full height of anchorage shelter for vessels in the roadsteads.

Point Allerton, which is at left of bird's eye view, is at the southeasterly entrance of the harbor. Is protected by a granite sea wall 1,202 feet in length. Its concrete foundation for a distance of 1,005 feet is protected by an apron and eight short jetties of granite rubble stone.

The bluff protected by this wall is not fully covered from storm action, and the sea wall should be extended westward for a distance of at least 150 feet, and the foundation should be protected with rip-rap.

Lovell's Island, which is much nearer the city, is protected on the western shore by a rubble stone apron 975 feet long, the northern shore is covered by a granite sea wall 750 feet long and the eastern shore protected by a granite sea wall 800 feet long and by two rubble stone aprons, one between the northern and eastern sea walls 1,440 feet long and the other south of the east sea wall 1,330 feet long. The detail views of Lovell's Island at bottom of front page, showing the construction of the sea wall and the rubble stone apron, are made from photographs taken especially for us at low tide.

Three prominent bluffs on Deer Island are protected by granite sea walls originally built about 1827. The north head wall is 1,740 feet long, the middle head wall 840 feet, and the south head wall 380 feet long. These walls have been partly rebuilt and in the weakest places backed with concrete.

Long Island is protected on the north head by a granite sea wall 2,081 feet long. Part of the foundation of the sea wall and of the beach at both its ends is protected by a rubble stone apron, aggregating 1,375 feet in length. During the last year 1,100 tons of rubble stone were landed at the beach and used to form a rip-rap protection for the beach west of the sea wall. This work will be continued this year.

Boston Harbor consists essentially of an inner and outer harbor, united by a deep waterway, and each accessible by distinct channels from the sea, widening into a deep and spacious roadstead.

The inner harbor lies to the north and westward of Long Island and receives the discharge of four rivers, the Charles, Mystic, and Chelsea Rivers from the north and the Neponset from the south. The direct entrance from the sea is by Broad Sound.

The outer harbor lies to the southward of Long Island and has a fine anchorage in Nantasket Roads, as well as in Hingham Bay, a well sheltered harbor southeast of Peddock Island. It connects with the inner harbor by the main ship channel through the narrows and by secondary channels east and west of Long Island. It is reached from the sea by Nantasket Roads, which lie south of Georges and Great Brewster Islands. Weymouth and Weir Rivers empty into the outer harbor. The range of tides at the navy yard is 9·8 feet and at the entrance to the outer harbor 9·4 feet.

The main ship channel before improvement had a least width of 100 feet and a least depth of 18 feet at mean low water. The general project for its improvement was submitted in 1867, and was to dredge the channel 23 feet depth at mean low water, 1,000 feet wide at the upper and lower middles and 685 at the narrows. At subsequent dates these figures were changed, and on June 30, 1892, the main ship channel was 23 feet deep at mean low water, 1,100 feet wide west of the upper middle, 800 feet wide at the upper middle, 1,000 feet wide at the lower middle, and at least 625 feet wide elsewhere.

The total amount of appropriations for Boston Harbor from 1825 to date are $2,304,276.10.

It is now proposed to have a uniform width of the main channel of 1,000 feet and to increase the depth to 27 feet at mean low water. According to an estimate submitted by Lieut.-Col. S. M. Mansfield, of the corps of engineers, the improvement would cost $1,500,000; but as the present inadequate depth of water in the channel causes nearly all of the deep draught vessels to anchor outside Boston Light and await the tide, so that delays of from three to nine hours in the delivery of mails and passengers are not infrequent, it is hoped that Congress will take some action in the matter.

Our thanks are due to Lieut.-Col. S. M. Mansfield, U.S.A., who is in charge of this district and under whose supervision much of the work has been done, for many facilities afforded us and for much of the data for preparation of this article.

Prizes for Mule Carts for India.

The Secretary for India has decided to offer five prizes, ranging from $3,750 to $625, for designs and models best adapted for mule carts for the transport use of the British army in India, after practical test in India of a full sized specimen. The competition is open to all nations. Intending competitors wishing for the fullest details as to the kind of cart required will be supplied with further instructions on application to the Director-General of Stores, India Office, Westminster, London, or to the Secretary to the Government of India, Military Department, Calcutta, British India. The designs and models, framed in needful detail, should be sent direct to the Secretary to the Government of India, Military Department, Calcutta. No designs or models reaching Calcutta later than September 30, 1893, will be allowed to compete. The time of transit for parcel post from London to Calcutta may be taken at twenty-four days. The instructions for competitors state, among other things, that the object sought is a design for a military transport cart for a mountainous country, with absolutely no local resources in the way of skilled labor or constructive material. The few existing unmetaled roads are steep, narrow, and rough. Carts would further be largely employed on unbridged and unmetaled tracks newly opened along hill sides and stony river beds, to meet the exigencies of military operations. The roughest handling is unavoidable. The cart must be entirely made of metal or of combinations of metals. As the merits of a design will be largely judged from its prime cost, competitors will consider how far light and strong, but possibly very expensive, metals should be used in place of commoner material, having a special regard to the importance, in the matter of durability, of the cart itself not being unduly light with reference to the load it has to carry. In this connection, 656 English pounds as a maximum, and 492 pounds as a minimum, are indicated as generally suitable limits of weight for an empty cart. This remark, however, in no sense need restrict designers' ingenuity in devising a lighter cart if of sufficient strength. The cart is to have only two wheels, to be provided with a brake or drag, and to be drawn by two mules. Each designer is to state in describing his cart whether he is willing to enter into a contract for its supply, and, if so, within what time and at what cost he is prepared to furnish a single specimen cart, 12 carts, 100 carts, or from 500 to 2,000 carts free on board in London, or delivered in Calcutta, Bombay, or Allahabad. The English language, although not obligatory, as German and French may be used, will necessarily have an advantage in the competition. English measures, weights, and prices are alone admissible in the specifications, drawings, and models.

A Beautiful Piece of Mechanism.

We have recently had the pleasure of seeing a remarkable model of a locomotive made by Mr. Henry Case, of Gloversville, N. Y., watchmaker. It runs by steam upon a track ten feet in diameter.

Weight of engine, 1½ pounds, with tender, 2 pounds 2½ ounces; length of engine, 8½ inches, with tender, 12 inches; height of engine, 3½ inches; gauge of track, 1⅜ inches; diameter of cylinders, 5-16 of an inch; stroke of piston, ½ inch. The piston heads are fitted up with sectional or ring packing; stroke of valve, 1-16 of an inch; length of main and parallel rods, 1¾ inches, connected up with straps, bolts, keys, set screws and boxes around the pins; length of links, 7-16 of an inch; width of links, ⅛ of an inch; diameter of eccentrics, ¼ of an inch; diameter of drive wheels, 1⅜ inches; diameter of truck wheels, ½ inch; length of whistle, 7-16 of an inch; diameter of whistle, 5-32 of an inch. The reverse lever in the cab is arranged with thumb latch, click and quadron. Also in the cab there is a throttle lever, deck lamp, safety valve, glass water gauge, lazy plug, steam gauge, which registers the pressure of steam. Also a gong in the cab and many other fixtures too numerous to mention. No. 60 Coates' cotton thread is employed as wicks for cab lamp and head light. These lights burn about twenty minutes. The driving wheel boxes are loose in the frame, fitted up with wedges, springs, hangers and equalizing bars. The tender will be found as perfect as the engine.

The materials used in construction of this midget locomotive are solid gold, silver, steel and brass. There are 1,815 pieces, exclusive of screws, bolts and rivets; 668 screws and bolts, 353 rivets, making in all 2,836 pieces.

AT the beginning of the eighteenth century all European armies had pontoon trains.

Decisions Relating to Patents.

REISSUE OF LETTERS.

Letters patent No. 171,425, issued December 21, 1875, to John C. Reed, for a non-conducting covering for "boilers, steam, water, and other pipes," claimed a covering composed of layers or wrappings of paper saturated with adhesive material, and compressed while being formed into tubular sections "of a thickness of one-half inch or more," substantially as described. A reissue of the patent—No. 8,752, granted August 10, 1879—omitted from the claims the quoted words. The Circuit Court of Appeals rules that this was an enlargement of the claim, rendering the reissue invalid, and that this effect could not be avoided on the theory that a covering of less than half an inch would not constitute the "thorough non-conductor" of the specifications; for, while a less thickness might not be sufficient for boilers and steam pipes, it manifestly would be for "water and other pipes." 1.

PATENTABILITY.

It is held by the Circuit Court of Appeals that in view of the prior state of the art, as shown by the patent of February 9, 1883, to Charles F. Woerd, and patent No. 206,674, to Hoyt, there was no invention in the mere introduction of springs in the mechanism for effecting the winding and hands setting engagement, in order to avoid liability of injuring the wheels by the force of the push or pull upon the short stem arbor, as claimed in letters patent No. 10,631, granted August 4, 1885, to Duane H. Church, for an improvement in stem-winding watches; but the claims are valid as covering a new and useful combination, the peculiar usefulness consisting principally in rendering watches and cases interchangeable. 2.

The United States Circuit Court lays it down that upon the idea of making an improvement, an adaptation of an old machine to the new purpose was proposed almost simultaneously by three distinct and independent parties, by an alteration of mechanism slightly different structurally, but the same in principle in each case, is evidence that such change was obvious, and did not involve invention. 3.

EXTENT OF CLAIM.

The Circuit Court of Appeals decides that if reissued letters patent No. 11,062, issued February 25, 1890, to William R. Fox, for an improvement in miter cutting machines, could be held to show patentable invention, it constitutes one of a series of improvements, all having the same general object and purpose, and the patent must, therefore, be limited to the precise form and arrangement of parts described in the specifications, and to the purpose indicated therein. 4.

Letters patent No. 261,054, issued July 11, 1882, to C. W. Siemens, as assignee of Frederick Siemens, cover "a tank for the continuous melting of glass, having gas and air ports, and of the depth herein described, for the purpose of forming, below the upper fluid portion of the metal, a layer of metal in a semi-fluid or partially solid condition, as and for the purposes described." In his specifications the applicant states that "in the fusion of window or other white glass there is a continuous descending and ascending movement of the particles throughout the mass, as is proved by the wearing away of the bottoms of shallow tanks. The advantage to be obtained from increasing the depth of the tanks will be the formation of a layer of chilled glass at the bottom, at which point the movement of particles ceases, whereby the bottom blocks will be protected from wear, the presence of stone in the glass avoided, and a larger proportion of first quality glass be produced." The Circuit Court holds that the increased depth of the tank was only for the purposes here specified, and did not, and was not intended to, provide for the alleged discovery of the so-called "vertical finding" of the glass. 5.

Letters patent No. 200,119 were issued February 12, 1878, to Henry G. Ashton, for an improvement in safety valves, consisting substantially of an ordinary spring valve with a pop valve chamber added, in combination with a valve seat, an inclosed spring chamber, and an inclosed discharge chamber. In his specifications he stated that his combination was very important "in all cases where the steam is prevented in any way from escaping freely from the hood or casing, as is often the case." In another place he stated that he provides holes or vents in the spring chamber for the escape of such steam as may enter it, but these vents were not mentioned in the claims, which covered merely the above combination, "arranged to operate as described." The Circuit Court of Appeals rules that the patent did not cover the use of the vent holes. 6.

1. Am. Heat Insulating Co. *v.* A. Johnston & Co., 52 Federal Reporter, 228.

2. Illinois Watch Co. *v.* Robbins, 52 Federal Reporter, 215.

3. Bromley Bros. Carpet Co. *v.* Stewart, 51 Federal Reporter, 912.

4. Fox *v.* Perkins, 52 Federal Reporter, 205.

5. Siemens *v.* Chambers & McKee Glass Co., 51 Federal Reporter 902.

6. Ashton Valve Co. *v.* Coale Muffler and Safety Valve Co., 52 Federal Reporter, 314.

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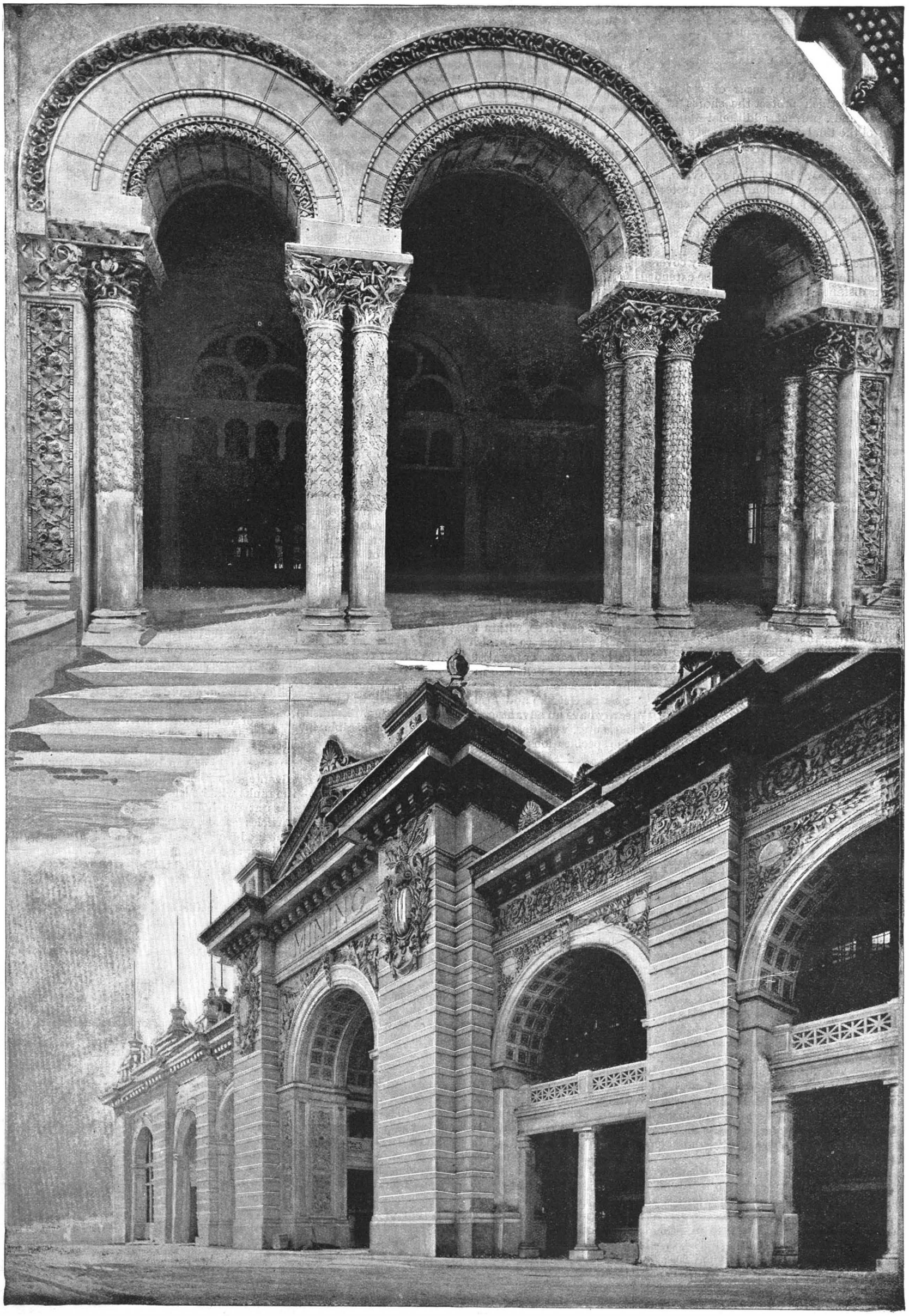
THE GREAT EXPOSITION ENTRANCES TO THE FISHERIES AND THE MINING BUILDINGS.

The several entrances to the Fisheries Building at the World's Columbian Exposition are of the design as shown in our upper illustration; but the ornamental work is carried out in such detail and is so elaborate as to be quite impossible of reproduction on a small scale. Each piece of ornamentation is complete and distinct in itself, and is a study in the lower forms of life. Fishes, frogs, eels, lizards, and other creatures constitute the conception of each piece of ornamentation, with cat-tails, flags, and other foliated designs interwoven for effective completeness.

The lower plate shows the south entrance to the Mining Building. This entrance is nearly opposite the Administration Building. This building is painted with a light, mild yellowish effect. Besides the frieze there is but little ornamentation on the south face or other parts of the building. Directly over the main entrance-way arch is the word "Mining" in plain Gothic letters. At either side is the shield of the United States in strong relief, with the words "In God we trust" engraved beneath. Figures symbolic of mining constitute the relief in the spandrel on each side of the arch. The north entrance is the same as this, except that a flight of half a dozen steps leads up to it.

Official Tests for New Magazine Rifles.

It will be seen by the advertisement in another column that a board of officers has been ordered to be assembled at the Springfield (Mass.) armory. Arms to be tested must be presented to the board before March 31.



THE WORLD'S COLUMBIAN EXPOSITION—ENTRANCES TO THE FISHERIES AND THE MINING BUILDINGS.

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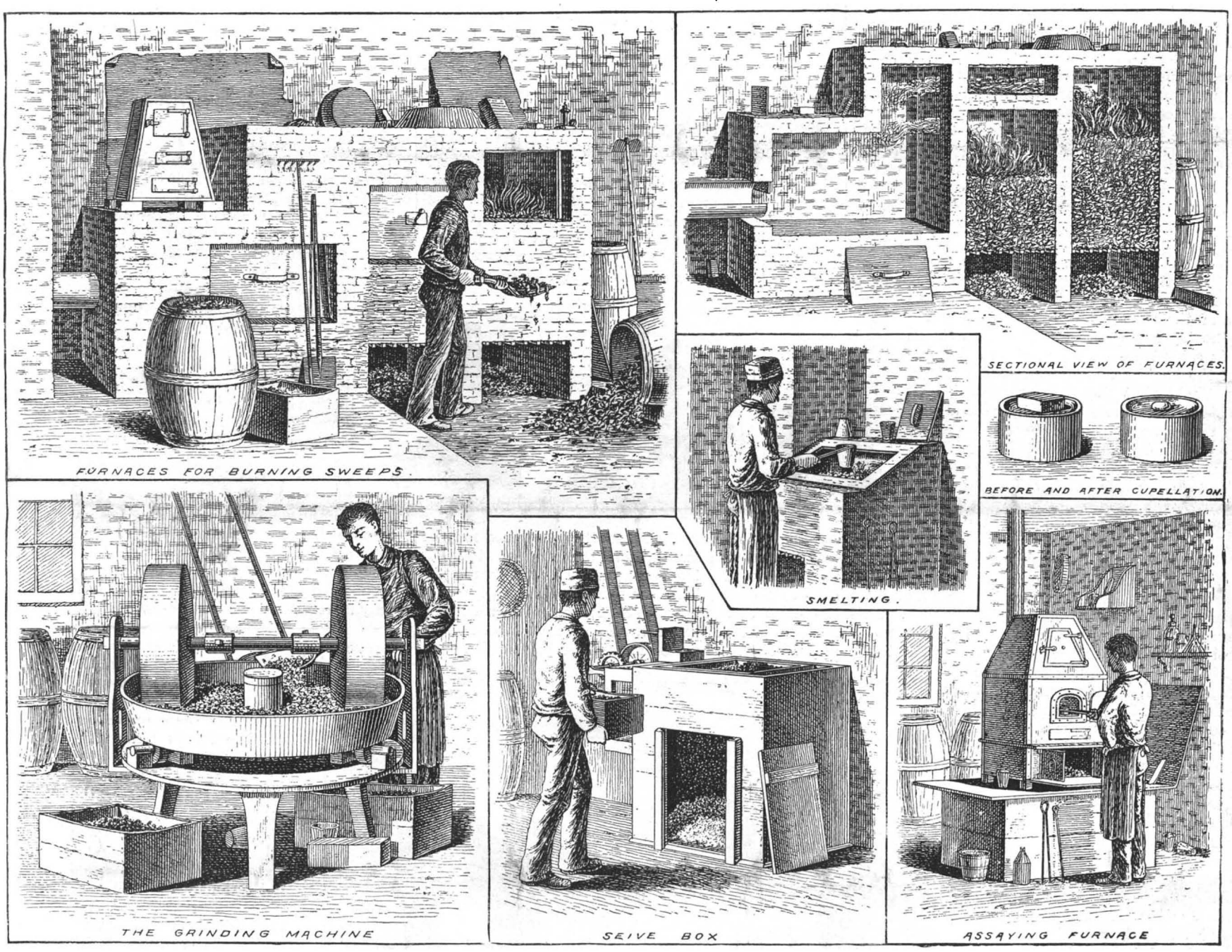
GOLD AND SILVER REFINING FROM JEWELERS' SWEEPINGS.

The illustrations of this subject were taken from the plant of J. Tunbridge & Son, Newark, N. J. The sweepings from manufacturing jewelry establishments, consisting of paper, dust, old crucibles, etc., are packed in barrels and carted to a refinery, where the material is first put into furnaces and burned. These furnaces are about 3 feet square and hold 3 to 4 barrels. The fire is started with wood and continues to burn until the whole material becomes caked and brittle. Each furnace is provided with a flue which opens into a dust collector, and gold and silver dust carried through these flues by the draught drops down to the bottom of the collector. After each burning the caked material is taken out and broken up into small particles and placed with the dust from the collector in a grinding machine. The revolving pan in which the material is ground is 3 feet in diameter, ¾ of an inch thick and about 8 inches in depth. The two cast iron wheels which crush the material revolve loosely on the shaft running across the center of the pan; these wheels are 2 feet in diameter, 6 inches in width and weigh 700 pounds each. Running through the center of the pan is a vertical shaft which passes through a large gear wheel connected to the bottom of the pan. This wheel connects with the main shafting, and when it is set in motion the pan revolves, causing the large wheels to revolve and crush the material. After grinding to a powder it is run through a 40 mesh sieve, the material not passing through being put back into the grinding machine. The fine powder, with a little lead and flux added, is then put into a crucible and smelted. On breaking the crucible after cooling, the lead button taken out contains the gold and silver. The button is put into a bone-ash cupel and placed in a muffle or assaying furnace. The cupels are from 1½ inches to 2 inches in diameter and from ¾ to 1 inch in height. The muffle in which the cupel is placed is made of fire clay and is about 14 inches in length, 7 inches in width and about 6 inches in height and oval shaped on top. The muffle is completely surrounded by fire when in the furnace, and when the fire becomes of a whitish red heat, the lead melts and is sucked up by the porous bone-ash cupel, leaving the gold and silver button. The gold and silver are afterward separated by what is called parting, which consists in boiling the alloy after rolling it out to a thin plate in strong nitric acid. The value of these sweepings varies greatly, averaging about $5 per barrel, although it has been known to run up as high as $500 per barrel.



GOLD AND SILVER REFINING FROM JEWELERS' SWEEPINGS.

Copper on Birds' Feathers.

At a recent lecture at the Royal Institution, London, Professor A. H. Church, after some preliminary remarks upon the obscurity which still shrouds so many natural coloring matters, and upon the difficulty experienced in isolating them, proceeded to give an account of turacin, its sources, mode of occurrence, properties, and derivatives.

Turacin appears to be peculiar to the plantain eaters, or Touracos, an African family of birds, which contains twenty-five species. Of these, eighteen species, namely, all those belonging to the three genera, Turacus, Gallirex, and Musophaga, contain this pigment in from eight to eighteen of the primary and secondary feathers of each wing. It occurs also in the head feathers and crests of some of these birds. It may be extracted by the most dilute alkaline liquids, producing a magnificent crimson solution. It has a perfectly well defined absorption spectrum. When a single red feather is burnt, the green flash of copper is distinctly seen; indeed, the pigments when extracted by ammonia, precipitated by an acid, and then dried, contain seven per cent of copper. One other animal pigment containing this metal is known; this is hæmocyanin, a respiratory pigment like the hæmoglobin of blood, not a mere decorative pigment like turacin. It contains, however, a very small proportion of copper.

Mention was made of turacoverdin, a green pigment occurring in the feathers of some Touracos, and apparently formed also by the exposure to air and moisture of turacin, or by boiling that substance with caustic soda. When turacin is suddenly and strongly heated, it gives off a crimson vapor which condenses into a crystallic substance containing both copper and nitrogen and yet quite distinct in its properties from turacin. Sulphuric acid dissolves turacin, turning it into a new pigment, turaco-porphyrin, which presents striking analogies with the hæmato-porphyrin similarly derived from hæmatin.

The amount of copper in the turacin of a single bird is rather less than one-fifth of a grain. As this metal is certainly present in bananas, the chief food of many species of Touraco, and is generally distributed, though in traces only, in the vegetable kingdom, there does not seem to be any real difficulty in accounting for its source. This pigment, turacin, presents some features of unique interest. It is extraordinary to find it occurring in a single family of birds, and in three genera of that family only, and not—so far as has been yet ascertained—in any other allied forms, such as the cuckoos, the woodpeckers, and the hoopoes, which all belong to the same natural order.

The percentage composition of turacin is carbon 53·69, hydrogen 4·60, copper 7·01, nitrogen 6·96, and oxygen 27·74.

Complicated Relationship the Cause of Suicide.

One of our medical exchanges relates the following as a fact:

William Harman, a resident of Titusville, Pa., committed suicide a few days ago from a melancholy conviction that he was his own grandfather. Here is a singular letter that he left: "I married a widow who had a grown-up daughter. My father visited our house very often, fell in love with my stepdaughter, and married her. So my father became my son-in-law and my stepdaughter my mother, because she was my father's wife. Sometime afterward my wife had a son; he was my father's brother-in-law and my uncle, for he was the brother of my stepmother. My father's wife—*i. e.*, my stepdaughter—had also a son; he was, of course, my brother, and in the meantime my grandchild, for he was the son of my daughter. My wife was my grandmother, because she was my mother's mother. I was my wife's husband and grandchild at the same time. And as the husband of a person's grandmother is his grandfather, I was my own grandfather."

That is So.

Inventors, like most other men, are willing to make money out of their inventions, but many of them go about their work in just the wrong way. Instead of devoting their time to the invention of machines or processes, or parts that are sure to be valuable to large numbers of manufacturers or laborers, they stick to the idea that fame and fortune come only to the inventor who makes a revolution. If such men will only look over history carefully they will find that the great fortunes and fame made of "revolutionizing" inventions are few and far between, while the greater number of successful inventors have made their fortunes out of things that are small, simple, and capable of general use. The small things that perfect existing large things are what should receive most attention.—*The Iron Industry Gazette.*

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Resistance to Cold.

The death of a centenarian Italian in a Norfolk town the other day, whose checkered life-history included service in Napoleon's "Grande Armée" during the disastrous Russian campaign of 1812, recalls attention to the fact that of all that host the Neapolitan contingent, 10,000 strong, withstood the cold and privation much better than the other divisions, recruited as these mainly were from Northwestern and Central Europe. So interesting and unexpected was this phenomenon, put on record by Baron Larrey, head of Napoleon's army medical staff, that the physiologists and hygienists of the time hazarded many explanations of it—explanations revived and checked during the Crimean campaign forty years ago, when again the Italian regiments of the allied forces were found to suffer less from the Russian winter than their French or even British comrades.

The view taken of the fact was this: That the Italians, born and reared in the sunny South, retained so much "caloric" in their systems that their supply of it continued long after their fellow soldiers from less favored climes had used up theirs. In support of this the experience of other Italians was invoked who, as teachers or artists, had settled in English or Scottish educational centers, and whose power of weathering the first northern winter was much greater than during the second and third, by which time, it was contended, their supply of "caloric" was exhausted and they were fain to have recourse to the creature comforts for which at first they had a positive repugnance. Australian colonists and Anglo-Indian officers, on their return to the mother country, cited their experience in a similar sense, and Claude Bernard's "Chaleur Animale" (1876) came afterward to translate those popular inductions into scientific language. No doubt during those Russian campaigns the Italian troops, new to such a climate and to such winters, felt the keenly oxygenated air as a stimulating restorative influence rather than as a depressing one, and all through the several weeks of their subjection to the novel conditions the "systemic response" to these declared itself in a heat production considerably in excess of the heat loss. The question, of course, arises, Could that "systemic response" continue at its maximum of force the second winter? Experience answered in the negative, and the testimony of Italian civilians resident in the British Isles, as well as of the Australians and Anglo-Indians aforesaid, points to the same conclusion. One element in the explanation of the phenomenon, however, must not be overlooked, and that is the greater temperance of the southern as compared with the northern European. To the former—and this was especially marked in the disastrous retreat from Moscow—the abuse, or even the sparing use, of alcohol was all but unknown. This abstinence put the Italian at a mighty advantage over the northern soldiery, who, as Sir Walter Scott has placed on vivid record, flew to cognac or vodki whenever they could get at it, and considered themselves happy if they could purchase "some hours of insensibility" by intoxicating liquors.

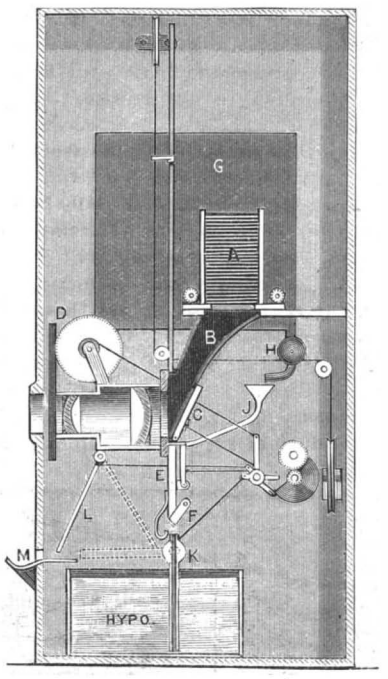
Then, again, Italians in general, and Neapolitans in particular, inured to the scantiest meals of macaroni and salad, felt the starvation diet of the forced marches much less than their French or Teutonic comrades. The same must also be said in the matter of clothing—the Neapolitans, even in abnormally cold winters, contenting themselves with an artificial warmth in raiment and fuel much below that to which the northern races are accustomed.—*Lancet.*

Breaking Up Their Old Ships.

The opinion, says the *Ironmonger*, is gaining ground in the North of England that, with one million tons of shipping lying idle, much of which will never be used again because it is obsolete and cannot be worked successfully against the economical modern type of steamer, it is the duty of owners to break it up and put the old metal in the market. Much of this sort of work has already been done on the Clyde, the Mersey, at Belfast, and at Barrow, and it is probable that during 1893 a further number of old ships will share this fate. Many of the agents who have ships on sale strongly recommend this course. It has the merit of common sense in it, as, if the ships cannot in future find remunerative employment, they may as well be converted into money as soon as possible, and clear away a vast tonnage which is standing in the way of further legitimate developments in sailing ships and steamships of modern type.

AUTOMATIC PHOTOGRAPHY.

Of all the many uses to which the automatic selling machine has been put, that of taking photographs seems the most remarkable. And yet this is what is being done now in several public places in New York and Brooklyn by means of a nickel-in-the-slot photograph machine recently patented by Mr. Pierre V. W. Welsh, of New York City. The operation, so far as relates to the exposure, development and fixing of the picture, is entirely automatic, and the little picture which the machine throws out, after a momentary washing, appears to be a marked success over previous efforts in this direction, as judged by the excellence of the work and the rapidity with which it is effected. The manufacture of these machines is now being carried on in a practical way by Mr. William F. Freeman, of No. 85 Beaver Street, New York City. The mechanism of the apparatus, as shown in the illustration, is inclosed in a case suspended by a cord in an open frame, a weight on the other end of the cord forming a counterbalance, so that the case may be readily moved up and down by the attendant to bring the exposure opening to the proper height for the picture to be taken. Below the exposure opening, in the front of the case, is a delivery tray on which the finished pictures are thrown out, and at one of the upper corners is a slot for the reception of the coin, the attendant in this instance furnishing, for an additional nickel, a stamped metal case for the finished picture.



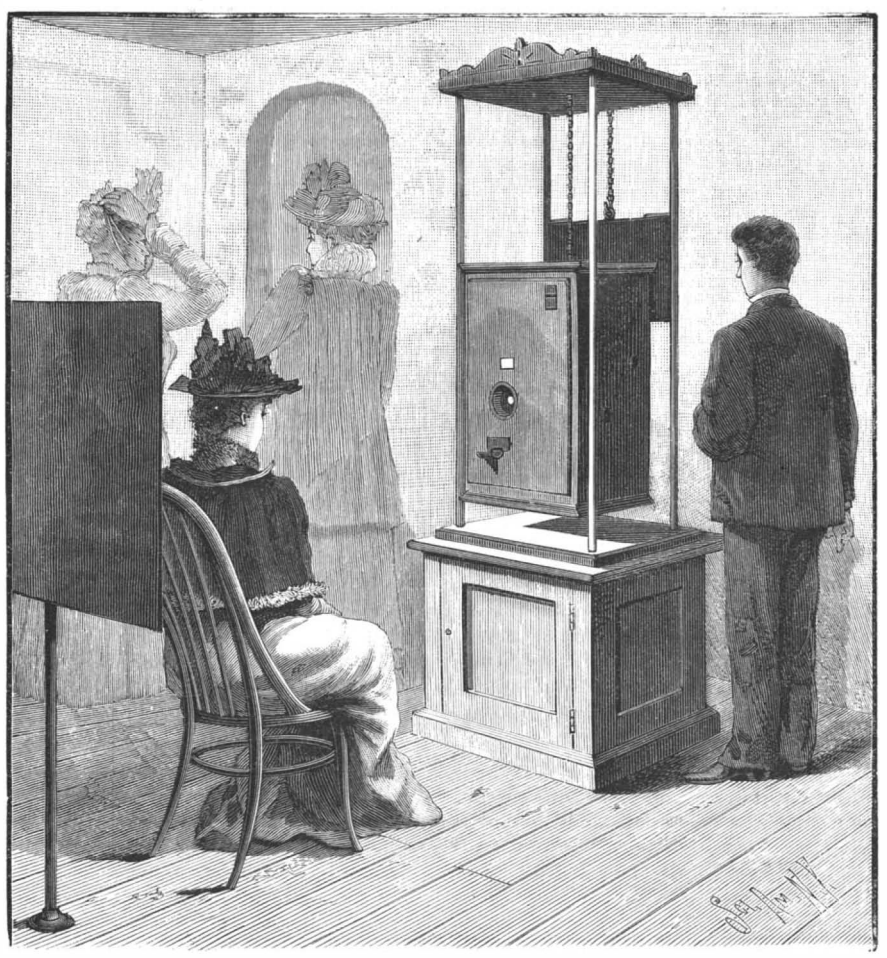
PHOTOGRAPH MACHINE.—Fig. 2.

The coin placed in the slot is carried by a chute to a plate connected with a tilting lever adapted to set in motion a clockwork mechanism, which drives a main shaft extending horizontally through the back part of the machine, this shaft carrying cams which effect the various operations of the several parts of the machine. The lens tube is of the ordinary style, and at its front end slides vertically the shutter, D, as shown in the detail view, Fig. 2. A rack on the shutter engages a gear wheel connected with a cable extending backward and downward to a connection with the main driving shaft, a cam on which causes the cord to be pulled to raise the shutter as the process commences with the dropping in of the coin, the shutter dropping back to place of its own weight after the exposure. At the inner end of the lens tube is a swinging fly, C, adapted to swing up in vertical position, the fly swinging in the lower end of a chute, B, through which drop the plates from the holder, A. Both the fly and the plate-delivering devices are operated from the cam shaft, the plates being of the usual kind employed in taking tintypes, and each revolution of the shaft deposits a plate in the chute. Immediately below the fly is the developing bath tank, E, into which the plate is mechanically dropped after exposure, the tank being cut off diagonally at its lower end by a valve, F. The developing liquid is carried in a tank, G, in the upper portion of the machine, a tube leading therefrom to a bulb, H, which holds a charge for the bath tank, the liquid flowing through the funnel and tube, J. The bulb is charged and its contents delivered to the bath tank with each revolution of the driving shaft, the exhaust liquid being in each case conducted to a waste tank. When the plate drops from the bath tank after being developed, it passes into a grooved receiver, K, which extends down into a fixing bath of hyposulphite of soda, the receiver with its plate being afterward raised to horizontal position, as shown in dotted lines, when a pusher arm throws the plate, now a finished picture, forward upon the delivery tray, M.

SPECIMENS OF THE PHOTOGRAPHS.

The time required to take a picture is 45 seconds, and the time of exposure is six or seven seconds, the lifting of the shutter and its dropping being plainly perceptible to the sitter. In this short period the plate is taken from the plate holder and held in position before the lens tube, then dropped into a developing tank, where the picture is brought out by the application of the developer, from thence being passed to a fixing bath and finally pushed out upon a receiving tray, where an attendant gives it a momentary washing. The accompanying half-tone pictures are photographic reproductions of photographs made on the machine.

The construction of the machine is such that all the movements are simple, easy and positive, and there is little liability of the parts getting out of order. The plate magazine will hold 240 plates, and when emptied it may be refilled in three minutes.



WELSH'S NICKEL-IN-THE-SLOT PHOTOGRAPH MACHINE.

IMPORTANT DECISION IN ENGLAND.—Ex-Congressman John S. Wise and O. T. Crosby went to London some weeks ago as experts in the suit of the National Telephone Company of Great Britain *vs.* the Leeds Tramway Company. The question at issue was whether the tramway company, whose wires worked injury to the wires of the telephone company, should not be restrained.

Electricity says: The English counsel had collected a mass of evidence showing that the tramway wires did not seriously injure those of the telephone company. Mr. Wise advised that all this testimony was irrelevant, and that the proper position to take was to admit the serious injury, but to claim equal rights to the earth with the telephone company. His advice was taken, and the court, Mr. Justice Kekewick, sustained Mr. Wise's contention.

Charles H. Haswell.

The editor of the *Engineer*, speaking of him, says with truthfulness there is no more striking figure in any profession to-day than that of Charles H. Haswell, who at the age of 84 + is still actively at work daily. Notwithstanding his years he is as erect as an athlete and apparently as tireless, he goes about, up and down long flights of stairs to offices where there are no elevators, transacts even trivial matters, and has, apparently, discovered the fountain Ponce de 'Leon sought for unavailingly. We think it would be hard to find anywhere in the world another professional man who is doing the work that Mr. Haswell does constantly, both physical and mental. We should be proud of the career of this veteran American engineer and honor him while he is still in the flesh.

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RECENTLY PATENTED INVENTIONS.

Engineering.

BOILER.—Harry A. R. Dietrich, South Bethlehem, Pa. This is a boiler which may be used for making steam or for heating purposes. It is constructed of a series of sections capable of being connected and disconnected, each section complete in itself, the sections being hollowed to form water chambers, and having depressions in their side faces forming combustion chambers, communicating with the fire pot, located between inner ribs around the sides of the sections. The ribs are substantially hollow extensions of the hollow sections, and when the boiler sections are placed in upright position, a cement or packing is used between the abutting sections.

Electrical.

ARMATURE FOR DYNAMOS AND MOTORS.—George Hoare, Newark, N. J. This armature core is constructed in the usual manner, with the exception of driving pins inserted in the slots in the heads of the armature, extending over the face of the core, and held in place by the winding, the wire being carried around the armature in a continuous piece, while the number of commutator bars is reduced to a minimum by diminishing the number of sections of the winding. The various portions of the winding are arranged so as to produce a perfect electrical balance, avoiding sparking at the brushes, while the winding insures perfect mechanical balance and consequent smoothness in running.

ELECTRIC RAILWAY.—Michelangelo Cattori, Rome, Italy. This invention relates to improvements in that class of railways in which a conductor is divided into sections, and a series of circuit breakers are arranged to connect the several sections, and operated by moving contacts carried by a car. The system may be used overhead as well as in a conduit if desired, the improvement relating principally to the circuit breakers and the means of operating them, the operating contacts being made to work easily, be durable, and to operate without sparking.

VEGETATION EXTERMINATOR.—Albert A. Sharp, Memphis, Tenn. This is an apparatus, including a dynamo and engine, or batteries, to be placed on a car or other vehicle, to cause a strong current of electricity to be sent through all the adjacent vegetation when the car is moved along the track. It is designed in this way to kill the rank vegetation which grows along railroad beds and highways in tropical countries. The current is applied to the vegetation by means of a brush, the same principle being applicable to the weeds and grasses of a cultivated field.

Mechanical.

STAVE TRIMMER AND JOINTER.—William J. Wright, Cooperstown, Pa. This invention relates to machines in which the billet is first trimmed to a proper width and then automatically fed into the machine. The billet in its course through the machine automatically controls and sets the bevel-cutting and the bilge-forming devices, which are operated to cut the bevel and form the bilge in exact proportions relative to the different widths of the billet. The machine is of simple and durable construction, of great capacity, positive and effective in its operation, and easy to manipulate.

BRICK OR TILE CUTTER.—James Cornelius and Edmund R. Collins, Brooklyn, N. Y. This improvement covers more especially the arrangement and operation of the wires for cutting a block of clay into bricks or tiles, there being combined with the cutting table a series of cutters held to reciprocate in the direction of their length and arranged at an angle to the clay body, to be forced through and sever the clay. The cutting wires are generally held stationary and the clay is forced through them, but by having the wires move, the clay may be more smoothly cut, making a nicer quality of brick or tile.

ROTARY STOCK CUTTER.—Isaiah Hardee, Burke, Texas. A disk having a flange is formed on a hub adapted to be secured to a spindle, a set of cutters seated in the disk abutting against the flange, while a middle disk on the first one contains a set of alternately arranged cutters, and a third disk on the middle one also has sets of cutters. The several cutters are arranged in seats arranged in a circle, the cutters for one section or disk being readily interchanged to permit of using the cutters of one head on that of another head, the cutters being used for right or left hand heads, and being especially adapted for use as matcher heads, ship lap heads, and ogee bats.

TIRE TIGHTENER.—Michael J. Fitzgerald, Aravaipa, Arizona Ter. This tightener consists of angle plates in a recess between opposing felly ends, toggle bars bearing endwise on the plates and also on a central screw, with a nut for the screw, adapted to press on the bar ends and spread the plates and fellies, thereby tightening the fellies on the tire at any time when the tire becomes loose. The improvement obviates the necessity of heating the tire to affix it in place by subsequent cooling and contraction, and also permits a removal and replacement of the tire, or the substitution of a new one, without the employment of skilled labor.

PUMP.—Elijah R. Hill, New Albany, Miss. This is an improved double-acting pump, very simple in construction and effective in operation, and arranged to cause a steady flow of water while the pump is in use. Its main piston is made hollow, with a valve seat at its bottom and inlet openings at its upper reduced end, while a piston valve sliding in the hollow piston has a valve adapted to be seated on the seat in the main piston, the piston valve being also provided with a piston adapted to close the inlet openings in the reduced end of the main piston.

MACHINE FOR CLEANING CURRANTS, ETC.—William Vickers, Jersey City, N. J. Combined with a revolving screen cylinder and a reversely revolving interior spiral agitator or brush, is a shaking preparatory cleaning sieve at the feed end of the cylinder, and a finishing, shaking, and cleaning sieve at its rear or delivery end. The machine is also adapted for cleaning other small fruits in a dried state, or, should the fruit be extra gummy, a perforated hot water or steam pipe may be arranged to pass water into the currants in the cylinder.

WASHER CUTTER AND CARRIAGE TOOL.—Thomas Thompson, New London, Wis. This is an implement which may be conveniently carried in a carriage and readily adjusted to hold the shafts in a raised position when the carriage is not in use, which is provided with a handy form of wrench to apply to the axle nuts, and which has also a washer cutter at one end, for cutting washers for the axles and other uses. The tool is of a simple and inexpensive character.

CABLE SUPPORT.—Gustave P. Wern, Brooklyn, N. Y. This is a support for cables used for propelling cars of carrying devices for moving coal to furnaces or gas houses, etc., the support being arranged to swing ont of position when struck by a car going in either direction, returning automatically to its normal cable-supporting position as soon as the car has passed. The arm supporting the cable swings on a fixed pivot, and has a hub with inclined surfaces adapted to travel on like surfaces on a sleeve turning with the arm in one direction, but held in a fixed position when the arm moves, in an opposite direction by a collar secured on the pivot.

Agricultural.

HARROW.—Wilber W. Hinkle, Hood's Mills, and Ira H. Gaither, Cockeysville, Md. This harrow consists of a metal plate having slots through which protrude curved teeth attached to rock shafts adapted to raise and lower the teeth. The implement is capable of a variety of accurate adjustments, the teeth being self-cleaning by such adjustment, and the harrow is designed to serve the purposes of both a cultivator and clod crusher.

Miscellaneous.

PHOTOGRAPHIC REGISTERING DEVICE.—Paul Tournachon, Paris, France. The rotatable cylinder over which the film passes is arranged in a suitable casing in connection with the other parts of the apparatus, by means of which a ratchet wheel is turned the distance of one tooth every time the registering device is actuated, the click of the pawl as it passes the tooth giving notice that an impression has been made, while the pawl also serves to prevent the registering device from turning back. An alarm is sounded every time an impression is made, and the number of impressions made can at any time be determined by looking through a window in the casing.

BRIDLE BIT.—James E. Driscoll, St. Paul, Minn. The cross bar of this bit has threaded openings in its ends, and the cheek pieces have sleeves sliding toward and from each other on the ends of the bar, on which they are held against rotation. By means of its adjustable parts the bit may be made to fit the mouth of any horse or mule, and these parts are covered in such a way that they cannot injure the mouth of the animal or fill up and clog with dirt.

LAMP LIGHTER.—Richard H. Jolly, Bucyrus, O. This invention relates especially to an improved lighter for locomotive head lights, providing a simple device that shall light the lamp without raising the chimney, one that can be operated while the locomotive is moving rapidly, and one which can be operated from the cab when desired. In a tube is held a spring-pressed plunger having a socket to receive the stick of a match, there being a friction ring in the forward end of the tube over which the match head rubs when the plunger is withdrawn and then released, the tube being so arranged that the lighted match will be projected close to the wick.

CRYPTOGRAPHIC INSTRUMENT.—Richard Harte, Croydon, England. This is an instrument for translating communications into and out of cipher in accordance with an adopted key. It is constructed of parallel strips fixed to a base plate, intermediate sliding strips working in grooves alternating with the fixed strips, normal and key alphabets being carried on the fixed strips, and a double index on each alternate sliding strip, with a double cipher alphabet on the remaining sliding strips, and an index on each of the cipher alphabet strips.

CLOTHES LINE DEVICE.—James J. Kinman, Petersburg, Ind. This invention provides devices to facilitate hanging out and taking in clothes from a fixed standpoint which may be under cover, the clothes line itself being afterward reeled up or taken in from the same standpoint. Pulleys are mounted on terminal posts, and the inner or operating pulley has an attached or connected drum with a hook or fastening to engage the line when it is to be wound on the drum.

WATER PROOF SUIT.—Ottee Van Oostrum, Portland, Oregon. This is a close-fitting suit made of mackintosh or other suitable water proof material, the coat having fastening flaps around the neck, the sleeves having elastic bands at the wrists, while the boots are hermetically attached to the trousers.

VEHICLE AXLE.—John D. Wilson, Belle Plaine, Iowa. The wooden body of this axle has a central longitudinal bore in which is held a metal tube through which extends a rod, whereby the wooden axle is strengthened against strain brought upon it in any direction. The rod has threaded ends on which are nuts bearing against the outer ends of the skeins on the spindle portion of each axle end, and the improvement is designed to be a great advance over wooden axles strengthened by metal braces.

CHILD'S CARRIAGE.—George B. Best, Englewood, N. J. This is a device which may be readily attached to the running gear of any child's carriage, the forward axle being pivotally connected with the side bars, a lever pivotally connected with the handle bar and normally pressed upon by a spring, while chains or cables connect the ends of the lever with the forward axle. The device facilitates the easy steering of the carriage, and when the device is released, it automatically returns the wheels to normal position.

THREAD CASE.—Samuel H. Boone, Douglas, Canada. This is a simple and inexpensive case which will hold a great many spools of thread, holding it so that the thread cannot slide in any way, and that the spools may be very easily removed when wanted. The thread may be easily arranged in assorted sizes and colors that it may be displayed to great advantage. The case is revoluble, and thus is easily turned to bring any desired number or color into the right position.

FAN.—James H. Irving, Jersey City, N. J. This is a hand fan in which a shaft is journaled in the outer end of the handle, in connection with swinging cross arms, a spring, and other features, whereby, upon pulling a cord, at the end of which is a ring, the fan may be rotated back and forth around the handle end, the ring being pulled by one of the fingers of the hand carrying the handle.

LOADING ATTACHMENT FOR CARTS.—Gustav Ch. Haag, New York City. This loader consists of a wheeled frame supporting an elevator and conveyor, there being a driving connection between one of the supporting wheels of the frame and the elevator, while there is a spring-controlled brush capable of limited vertical movement near the bottom of the elevator. The attachment may be readily applied to any cart, being operated entirely independent of the cart, from which it may be quickly removed when not in use.

DISINFECTING DEVICE.—John Pickering, New York City. This is a cheap and simple device in which disinfecting material may be placed, to locate in a tank used for flushing purposes, a sufficient quantity of the disinfecting solution being ejected at each discharge of the tank to thoroughly disinfect the parts when the water is applied.

Designs.

MEDAL.—Joseph A. Yount, Laclede, Mo. This medal is thirteen-sided, corresponding to the number of original States of the United States, and has on the front a head of Columbus and on the reverse one of the Chicago Exposition buildings.

SPOON.—Charles Osborne, New York City. The edges of the shank and of the flattened portion of the handle of this spoon are formed into raised rib-like figures, broken by leaf-like figures, and at the top of the handle is a flower-like figure in the shape of an open fan.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS AND PUBLICATIONS.

GEOLOGICAL SURVEY OF MISSOURI. Arthur Winslow, State Geologist. Vol. II. A report on the iron ores of Missouri, from field work prosecuted during the years 1891 and 1892, with 62 illustrations and one map. By Frank L. Nason, assistant geologist. Published by the Geological Survey. Jefferson City. 1892. Pp. xxvi, 366. Vol. III. A report on the mineral waters of Missouri. By Paul Schweitzer, assistant geologist. Embodying also the notes and results of analyses of A. E. Woodward, assistant geologist, from field and laboratory work conducted during the years 1890 to 1892. With 45 illustrations and one map. Published by the Geological Survey. Jefferson City. 1892. Pp. xxiv, 256.

We note the receipt of the second and third volumes of Professor Winslow's report on the geology of Missouri. The third volume is devoted to the mineral waters, and with its numerous illustrations and analyses may be considered one of special value. The author, Dr. Schweitzer, well remembered by the old graduates of the School of Mines of Columbia College, speaks of the work as having been largely a labor of love. Those who knew him of old will cheerfully give full belief to this. The photogravures of the different springs are exceedingly picturesque, and the whole subject is linked together by exceedingly clear and concise chapters on the origin of mineral waters, their analysis and composition, their classification and the therapeutics of the subject.

DISCUSSION OF THE PRECISION OF MEASUREMENTS. By Silas W. Holman, S.B. New York: John Wiley & Sons. 1892. Pp. vii, 176. Price $2.

Electricity has been defined as a science of measurement. This definition may now be extended to all physics. Just as chemistry is a science of weighing, so physics has now become a science in which the exact determination of dimensions is all-important. In the present work, we find the measurements treated scientifically. The personal equation, the law of deviations, direct and indirect measurements, and all the important features of modern practice are fully developed. It will be seen that the work covers a field of importance increasing daily, and the book should be in the hands of all physical workers.

DRAWING AND ENGRAVING: A BRIEF EXPOSITION OF TECHNICAL PRINCIPLES AND PRACTICE. By Philip Gilbert Hamerton. London and Edinburgh: Adam and Charles Black. New York: Macmillan & Co. 1892. Pp. xvii, 172. Price $7.

Mr. Hamerton has made up this book from matter contributed to the 9th edition of the "Encyclopædia Britannica" on the subjects of drawing and engraving, preserving the style and treatment of the Encyclopædia. The author has revised it and added a little to it. The work is produced as a veritable *edition de luxe*. A number of plates, in the present edition on drawing paper, illustrating often examples from the early engravers, are given, and on the thin paper guard leaf opposite each plate is given the description of the subject matter, in red letters. The text, on very large and heavy paper, is an elegant example of the printer's art. The work treats not only of the art aspect of the subject, but also of the mechanical, telling how engravings of the different classes are done, and giving samples of unfinished engravings to illustrate the processes. The characteristic binding in full canvas is in accord with the beautiful description of the work proper. We have said nothing about the text. Hamerton is well known as one of our most charming art writers, and any work of his requires no criticism in these columns. The introductory chapter is of peculiar interest, in which he touches upon primitive drawing, especially, using the ancient Egyptian and Japanese art for his examples. The two examples of Japanese figure drawing, one of angular type, the other in gentle curves, are of special interest, as exemplifying the analysis to which the author has subjected the subjects of his discussions.

MINERAL SPRINGS AND HEALTH RESORTS OF CALIFORNIA. With a complete chemical analysis of every important mineral water in the world. Illustrated. By Winslow Anderson. San Francisco: The Bancroft Company. 1892. Pp. xxx, 384.

A discussion of the mineral springs of California, and the comparison with those of other resorts, represents a prize essay to which the annual prize of the Society of California was awarded on April 20, 1889. The work contains very numerous analyses, is quite profusely illustrated, and of course takes the form of a panegyric of the great State. There are several indexes, as well as a table of contents and list of cuts, which add materially to its value.

ATMOSPHERIC RESISTANCE AND ITS RELATION TO THE SPEED OF RAILWAY TRAINS. By Frederick U. Adams. Chicago: Rand, McNally & Co. 1892. Pp. 89.

The author of this work is a great believer in the reduction of air friction in trains. His method of arriving at a result involves a system of vestibuling trains and of shielding the moving parts, so as to offer a smooth surface to the air. His illustrations of the present system, with the drafts created by the passage of the air all shown, is really a wonderfully graphic presentation of what cannot but be considered defects in the existing system of things. He believes that he can so reduce resistance as to greatly increase the speed of railroad trains, and he holds that atmospheric resistance, and nothing but atmospheric resistance, fixes the limit of speed. It is impossible to avoid being impressed by the author's views, and his presentation of them is quite graphic.

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SCIENTIFIC AMERICAN BUILDING EDITION.

MARCH, 1893, NUMBER.—(No. 89.)

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7. Sketch of a tasteful design for a three-family cottage, to cost about $4,500.
8. Plans and elvations of an English cottage of quaint and pleasing design.
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Notes & Queries

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Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

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Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(4719) H. H. B. asks: What is it that makes telegraph wires hum on a cold stormy day when there is no apparent wind blowing? A. There is wind blowing across the wires somewhere in the neighborhoo , or the striking of the wires by the rain makes the humming.

(4720) W. H. T. writes: Please give rule for setting a carriage axle, and what receipt can you give for heating iron through in the shortest time? A. The bottom of the taper axle should be horizontal or parallel to a straight line through both axles. For very light carriages some prefer to have the underside droop a little, so that the wheels tend to run toward the shoulder. Iron should not be heated in the shortest time for its good. We have no receipt but a forge fire for heating iron in the shortest time.

(4721) W. C., Wichita, asks: Can soft pine floors be polished to look like hardwood, so that rugs may be used instead of carpets, and how? A. Soft pine if freshly laid makes a good surface for polishing, and according to the selection of the wood by its grain may be made quite ornamental. A floor that has been used should be made perfectly clean, and if possible planed. Then a coat of boiled linseed oil, well rubbed into the floor and dried, gives a good surface for wax polishing, which may be made by dissolving a half pound of beeswax in a quart of turpentine. With this rub the floor to a polish with a hard brush or a coarse flannel rubber.

(4722) M. B. asks where he can get aluminum steel or nickel steel, also state if it is adapted for tune (musical instruments). A. Aluminum and nickel steel are not as yet regularly on sale. Their manufacture so far has been experimental, and with steel works supplying steel for ordnance and armor plate. A few trials have been made for tools, bnt manufacturers do not see enough in it to induce its introduction to the market as tool steel. Probably it will make good music wire, as it is said to be slightly harder than carbon steel.

(4723) H. H. says: I would like to ask how large a boat an engine with a cylinder 2½ by 3 inches stroke would move at the rate of about 8 or 9 miles per hour. I would like to make the boat of sheet metal if it will not be too heavy. I expect to carry about six persons. Do you think No. 18 iron would be too light for the sides of the boat, if it were well braced? Please state what would be best for a boiler for such a boat. Would ⅛ sheet copper be heavy enough if I make a porcupine boiler with the shell 8 inches in diameter and copper tubes brazed into it? Would you recommend this form of boiler for the purpose? A. Your engine is suitable for a 16 foot boat with a 15 inch propeller, with which you may make 7 miles per hour. You will find difficulty in making good lines for your boat with metal, unless you have the proper dies to press the metal into form for a boat. No. 18 will be thick enough. Your boiler should have 24 square feet of fire surface. You cannot make a porcupine boiler by brazing in the tubes. It makes the metal soft and the joints will not be reliable. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 702, for illustrated description of small pipe boilers.

(4724) J. J. G. writes: If I fill a tub say half full of water and place it on the scales, and then put into the tub a fish weighing say twenty pounds, will the tub, fish, and water weigh any more than the tub and water did before the fish was put into it? I mean to take a live fish. A. The tub and water will weigh as much more as the weght of the fish, whether it be alive or dea . Anything that has weight, if placed in the water, adds its own weight to the water. 2. Will a log or boat drifting in tide water go faster than the water that propels it? A. The boat or log may drift slightly faster than the surface current, for running water does not move with the same velocity throughout its depth, but moves faster just below the surface than on the surface and at the bottom. With anything floating with some depth, the faster undercurrent will propel it faster than the surface current. 3. Will you please tell me how to braze iron with brass or copper? A. For brazing iron, cut small strips of sheet copper or brass, make the surfaces to be brazed clean, and rub the surfaces with borax or wet them with borax ground to paste in water. Wire the parts together, apply a strip of the copper or brass to the edge of the joint on the upper side, and apply borax to the solder. Heat slowly to the melting point of the copper or brass, which will draw entirely through the joint.

(4725) C. A. R. asks: 1. How many volts does it take to run a 16 candle power Edison lamp? A. The standard Edison lamp is 110 volts. 2. Can you tell me of some cheap book that tells how to make a storage battery that will run a 16 candle power lamp? A. Any storage battery will run a 16 candle power lamp, provided you have enough cells to produce the required electromotive force. It will require 26 cells to run one or two 50 volt 16 candle power lamps. You will find such a storage battery described in "Experimental Science," also in the SUPPLEMENT. 3. Can you run a lamp with bichromate of potash for any length of time, and how many cells would it take? A. You can run a lamp by bichromate batteries, but it is an expensive and troublesome method of making light. 4. Can an electroplating dynamo be used for running a lamp with success? A. The electromotive force of an electroplating dynamo is too low for electric lighting purposes. 5. Can you tell me of any cheap book that tells how to make and cast carbon plates? A. You will find a description of a method of making carbons in "Experimental Science."

(4726) W. O. S. asks how the windows of a store can be kept clear from steam in cold weather. A. In order to have clear glass in show windows, the air behind the glass must be of about the same temperature as the outdoor air. The windows may be made completely clear by a second window to completely inclose the show window back of the goods. The inclosure to have small ventilators at bottom and top, which can be closed when necessary to prevent the entrance of dust.

(4727) T. B. P. writes: One night during the recent cold spell, on going to my window, I noticed that considerable moisture was collected on the panes. Nearly opposite the house is an arc lamp. When I truned my head in its direction, I was astonished to see three separate and distinct rainbows, seemingly clustered around the light as a center. Each bow was clearly defined, and there was a clear space between each one. I have never seen or heard of a rainbow of this description, and had never supposed that such a formation was possible on a plane surface. A. If the moisture was frozen, the phenomenon to which you refer was that of diffraction. The colors are caused by the passage of light over the fine edges of the crystals. You will find this matter described in the SCIENTIFIC AMERICAN, vol. 64, page 281, also in "Experimental Science."

(4728) I. H. L. asks how steel is blued. Such as watch and clock hands, rifle barrels, etc. A. The bluing of watch and clock hands is done by polishing the surface and heating upon a hot iron plate and cooling in water as soon as the proper color is obtained. For the bluing of rifle barrels see SCIENTIFIC AMERICAN SUPPLEMENT, No. 830, "Gun Wrinkles."

(4729) J. M. R.—The object you describe is a fungus known to science as *Corynites Ravenelii*. It belongs to an order which includes several genera, the species of which are popularly called "stink horns," on account of their shape and their offensive odor.

(4730) H. J. D. asks if the electric motor in SUPPLEMENT, No. 641, can be used as a dynamo. How fast should it be driven? If so, what power of an engine would be required and what electromotive force, and how many amperes of current would it give? A. The electric motor to which you refer can be used as a dynamo by substituting a cast iron field magnet for the wrought iron one, but we would advise you to follow some other form of machine for a dynamo. No calculations have been made to show what electromotive force or current the motor would yield if used as a dynamo.

(4731) S. K. G. asks: What causes the so-called "burning out" of an incandescent lamp? Is it always the result of the burning and breaking of the filament, caused by its life limit being reached, or is it sometimes caused otherwise? Also, does this burning out destroy or partly destroy the vacuum in the glass bulb, or does it remain as perfect as ever? A. The burning out of incandescent lamps is generally due to the disintegration of the carbon by the current. It is, however, sometimes caused by a leak in the bulb and the burning out or actual consumption of the carbon due to the presence of oxygen. The failure of the carbon filament does not necessarily affect the vacuum.

(4732) J. E. Q. asks: 1. What is the easiest and quickest way to remove the copper coating on arc light carbons, without injury to the same? A. You can remove the copper from carbons by means of nitric acid. After the copper is dissolved wash the carbons thoroughly with water. 2. How is insulated copper wire wound on curved field magnets, the outside being so much greater than the inside curve? A. The coil of wire is allowed to spread on the outside.

(4733) J. B. D. asks: How can I construct an inexpensive telephone for communication between a couple of rooms? A. Over two short tin tubes 1½ inches in diameter stretch moist diaphragms of parchment, and secure them by means of fine copper wire or strong thread. Pierce the diaphragms at the center, connect them by a strong thread passing through the perforations and knotted on the inside of the diaphragms. This will form an effective acoustic telephone.

(4734) Y. M. C. A.—Hard-drawn iron wire has more resistance than soft iron wire. Taking the resistance of copper as 1, the resistance of iron would be a little more than 6, and of German silver 13. We can furnish copies of recent patents at 25 cents each. To become an electrical engineer, you should attend one of the electrical schools, or the electrical department of one of the colleges. A mixture of litharge and boiled oil makes a cement in which there is no moisture. Oxide of zinc mixed with a solution of chloride of zinc makes a hard cement which is practically dry as soon as it sets.

(4735) N. L. asks: What solution is best to preserve wood from warping or drawing when exposed to rain and weather? A. Nothing better than thorough oiling with linseed oil to keep wood from warping.

(4736) F. J. O. asks: Which consumes the most power—a bevel gear or a mule stand? They are used to transmit power from one shaft to another acting at right angles. A. "Mule" loses more power than good bevel gear. Friction of the two pulleys, friction of belt and creepage is the cause of loss of power.

(4737) J. R. W. asks how to make soft solder take to chilled cast iron. And also how to soften chilled cast iron. A. Use pure tin, or 2 parts tin, 1 part lead for solder; flux with muriate of zinc and ammonium chloride. It is well to rub the rough surfaces, if it is a fracture, with a brass wire brush, so as to give a coating of brass. The soldering is apt to be very unsatisfactory. (Tinner's soldering acid.) Soften chilled iron by long annealing in an iron box charged with pulverized charcoal.

(4738) F. L. S. says: We have a set of hay scales and sometimes we have to weigh wagons that are too long to go on them. Can we get the correct weight by weighing one end at a time and then adding the two weights? A. Weighing a wagon as you propose will be approximately correct.

(4739) A. R. P. asks: Where can I learn something about the formation of dust balls in old violins? A young friend of mine has found such a ball in his violin, and thinks he has heard they are not uncommon in old instruments. Are they mentioned in any scientific book or treatise? A. We have no literature referring to dust balls in violins. One of the oldest dealers in violins in New York thinks it a mere accident from allowing the violin to be exposed to dust, and the vibration gathering the dust that accumulates on the inside, in time forming a ball.

(4740) D. C. writes: We are located in the vast gently undulating prairie, and have fine spring water, generally found in the slight depressions. Often we need to locate the origin of these springs, but find it next to impossible. Will you kindly instruct us how to, without extensive digging? Except for these gentle undulations, we must go one or several miles from the spring to find an elevation of 50 to 100 feet above them. A. The slight depressions in the land where springs occur are only the seepage points from the local surface water of the immediate neighborhood. It is seldom that they have a deep origin, although considerable elevation of land at a moderate distance will add to the flow of sprirgs along the valley lines of depression of the land.

(4741) S. T. writes: I have a house painted and sanded. It has at least 8 coats of paint and sand on it. It has begun to blister. Will you please let me know the best way to get the paint off the woodwork so that I can repaint it and make it look nice? Some of our painters here say burning is best. That is a very slow process. Would it not be best to take it off with some kind of acid? A. Probably the burning process is best and quickest. The blowpipe burner with a broad flame should be used, and with a broad scraper the paint will be quickly removed. Potash lye may be used, but is not so satisfactory as burning.

(4742) E. P. W. writes: I wish to know the exact horse power it will take to pump water in a suitable sized cylinder, with an opening of one-half inch constantly open, and maintain a pressure in cylinder of one thousand pounds pressure per square inch. Will a dynamo of one hundred horse power run an electric motor of one hundred horse power? Suppose they were side by side, what loss would there be in horse power between dynamo and motor? A. You will require 12 horse power in maintaining the jet under the pressure named. The friction of a pump to do the work will require at least 4 horse power more, or 16 horse power in the steam cylinder of the pump. There will be from 10 to 15 per cent difference in the horse power of the two motors as described.

(4743) F. G. S. asks: What capacity have large steamers or vessels for pumping water out of the hold in case of leakage, or about what amount of water in gallons per minute? A. The large ocean steamers have pumping capacity for 3,000 to 8,000 gallons per minute.

(4744) W. H. C. says: In the South Kensington Museum, London, there are some old steam engines over one hundred years old. Could you inform me in your columns how the cylinders were bored, as there were no slide rests nor boring machines in those days, and as they are quite large, they would be difficult to bore with a hand tool? A. Cylinders for steam engines were made of considerable size nearly two hundred years ago. The first one used in America, in the copper mine near Newark, N. J., previous to the Revolution, and now in Newark, is about 30 inches diameter by 8 feet stroke. The cylinders of the early-timers were bored and face with boring bars, and may have been done by hand power. The reboring of cylinders with a boring bar is now accurately done by hand power. The men that invented and built the first steam engines were equal to designing and building the necessary tools for doing the work.

(4745) Machinist writes: Please advise of the result from using a boring bar under the following conditions: The work to be fastened to the carriage of engine lathe and fed forward to the single cutting point of a fixed cutter in a boring bar, revolving on centers of lathe, as often used in machine shops. The lathe to be in a normal condition excepting the tail stock, which will be set over more or less, within the capacity of lathe, as provided for by set over screws on tail stocks of lathes. Will a hole bored under above conditions be cylindrical or otherwise? A. A hole bored under the conditions named will not be a cylinder, and with the small angle attainable in lathes for variation in line from the center, the amount of distortion will be mathematically small, yet it will be elliptical in form, with its longest axis in the vertical. The plane of revolution of the cutter being at right angles vertically and at an angle horizontally, the difference in the two diameters may be readily computed from the elements of a right-angled triangle, or demonstrated geometricaly by increasing the angle in a diagram. A delicate calipers should show the difference with a considerable set-over of the back head.

(4746) L. H. asks how to temper springs for shotgun locks. A. For hardening and temperinggun lock springs, a charcoal fire should be used with very little blast, so that the temperature of the fire will be low enough to prevent overheating the thin parts. Take the spring by its shank in a light tongs and dip it in a pan of lard oil, place it over the fire, heat gradually until the oil takes fire, then carefully cover with the live charcoal and heat to a full cherry red evenly over the whole spring, then plunge edgewise in the pan of oil; remove before it is quite cold and place over the fire and heat slowly until the oil takes fire, then plunge in the pan of oil.

(4747) W. P. S. asks how to cast lead type. I want to set up a quantity of type and make a mould and cast the metal so it will print as well as the type. Let me know how to make type metal. A. You will find the process of stereotyping and the necessary machinery illustrated in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 191 and 310. A good metal for stereotyping is made of 9 parts lead, 2 parts antimony, and 2 parts bismuth. This makes a very fluid metal for amateur work.

(4748) D. L. G. writes: I say that bichromate of potash batteries and gravity batteries are secondary batteries. B. says that they are primary batteries, and that a Burnley dry battery is a secondary battery. A. Bichromate of potash batteries, gravity batteries, and the Burnley battery are all primary batteries. It is stated, however, that the Burnley battery may be recharged or restored by submitting it to a strong current for a time.

(4749) J. E. E. writes: Please state through your paper what is best to use for active material to put on the lead plates in a storage cell. Also what to use to dip the incandescent lamp in to color the glass various colors. A. For your plates use a paste of red lead mixed with a dilute solution of sulphuric acid (acid 1 part, water 10 parts). Incandescent lamps can be colored for temporary use by dipping them in colored lacquers or into colored aniline.

(4750) E. E. W.—The experiment with the dog conducted at the Edison laboratory, to which you refer, was made with magnets steadily excited from continuous current; but experiments have been tried with alternating current and with alternating magnets on the head of a person, without marked results.

(4751) H. H. N.—T become a first-class electrician, one of the first requisites is a good knowledge of mathematics. Without this you cannot expect to proceed very far. Of course, the better way to gain a practical knowledge of electricity is to take a course in one of the technical schools; but if this is impossible, you might study electrical works and at the same time demonstrate every problem as you proceed by an experiment.

(4752) L. H. D. asks: 1. How is oak sawed to be quartered? A. Quarter-sawed oak is made by sawing across the center at right angles, cutting the log into four quarters. Then saw each quarter into boards at 45° to the quarter cuts and across the rings. 2. Does the process incur much waste? A. There is greater waste than by the ordinary cuts. 3. Is oak 30 inches in diameter better than 12 inch or 15 inch for that purpose? A. The largest logs give the least percentage of waste and make the best quarter-cut lumber. 4. Is sound, large white oak less hard in the heart than near the outside of the tree? A. The heart wood is harder and more durable. 5. Is there any objection in forcing water up hill to have the pipe follow the undulation of the ground, or must it be a gradual rise to the highest point, a distance of 1,500 feet? A. There is no objection to following the ground grade in laying a water pipe, provided it is well protected against frost and plugs put in at low points to facilitate drainage if required.

(4753) N. B. T. asks: How large a meter shall I want for thirteen 3 foot burners and a gas stove with four holes and an oven and broiler? Is a 5 light large enough? A. You would do better to use a 10 light meter. If all your burners, stove, and broiler were going at once, the 10 light would be none too large.

(4754) E. S. asks: Is there any way to prevent the soft water from condensed steam dissolving the iron of steam heating pipes? I am having trouble with my pipes leaking from this cause. A. The water of condensation is to a considerable degree a solvent of iron of the quality used for making pipe. Such iron is not pure, containing slag and particles of some unknown substance that seems to have a galvanic action, producing pock holes that sometimes eat through pipes in from three to five years. Again, where the water runs along the bottom of wrought iron pipes, channels are cut partly by solution and partly by attrition, which are known to cut through a pipe in four or five years; while, on the other hand, the vast bulk of steam heating pipes are in use all the way up to twenty-five years with only an occasional leak from internal causes. The cause is largely in the quality of the iron of which the pipe is made. The use

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of homogeneous or steel pipe is probably the only remedy. The same pitting and cutting is known to affect iron boiler tubes, and is a source of much trouble with vertical tubes with internal circulation, although the water is not pure and soft as from condensed steam.

(4755) Z. asks: How can I remove the acid from beef tallow so that it will not corrode iron when used as a lubricator? A. Boil or melt and stir into very hot water a small quantity. Test the water with litmus paper to see if it contains acid. If so, then treat the tallow before you use it in the same way, adding a slight excess of caustic soda to the water, and heating and stirring thoroughly. The tallow will separate on cooling.

(4756) J. S. asks: Is water absolutely non-compressible? Or can its bulk be reduced by any known method? A. Water is slightly compressible. No substance is non-compressible at existing temperatures.

Replies to Enquiries.

The following replies relate to enquiries published in the SCIENTIFIC AMERICAN, and to the numbers therein given.

(4655) In query No. 4655, where X. Y. asks for an acid or spirit that will soften glass so he can bore holes in it with an awl, "well, hardly;" but your advice is good as to a diamond drill or glass tube and emery. But please allow me, for the benefit of X. Y. and others, to give a cheap and simple receipt (if we may call it such) of drilling holes in glass with a common steel drill by using turpentine, the same as you would oil in drilling iron or steel. I have bored some holes as large as ⅜ inch by this process and have never had any trouble when my drills were hard and speeded high.—J. T. PRETTYMAN, M.E., Portland, Ore.

TO INVENTORS.

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March 7, 1893,

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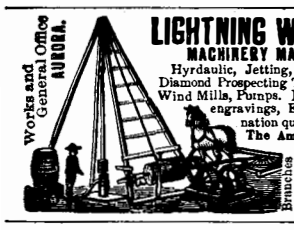

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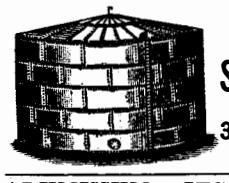

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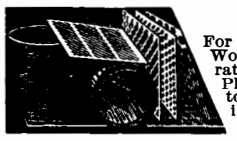

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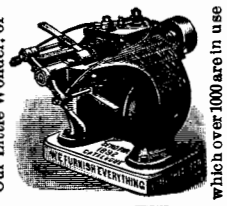

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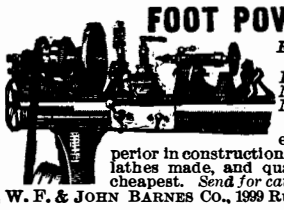

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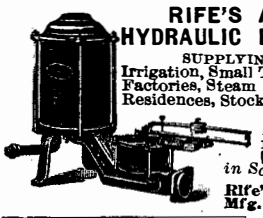

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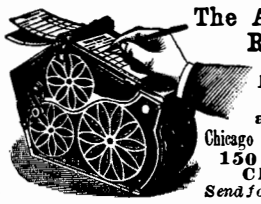

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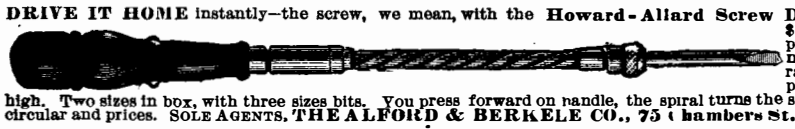

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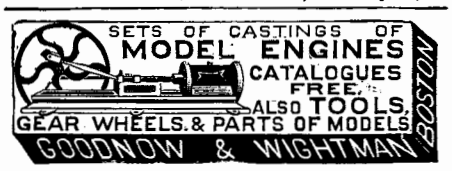

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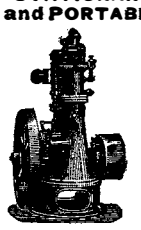
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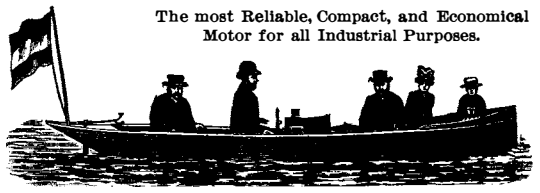
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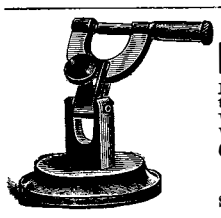
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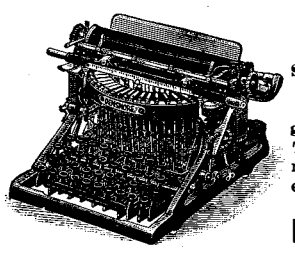
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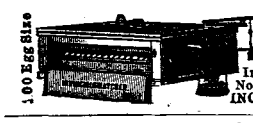

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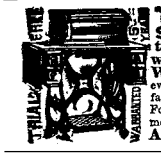

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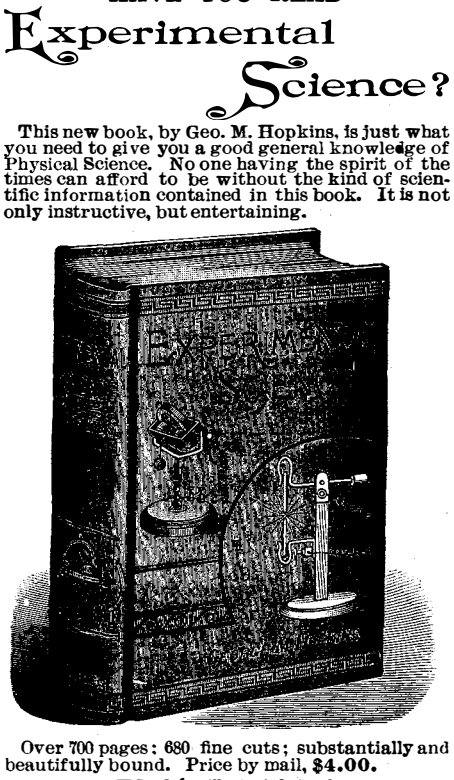
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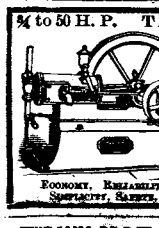

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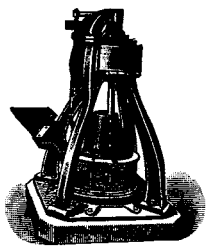

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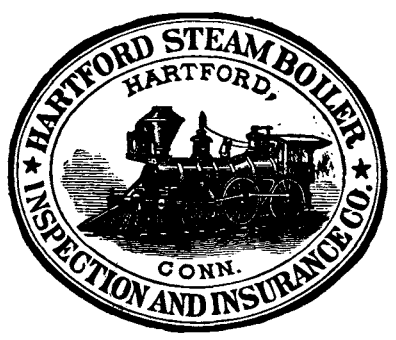

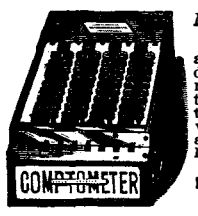

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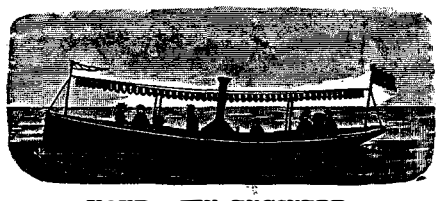

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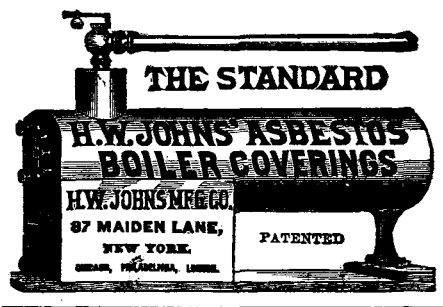

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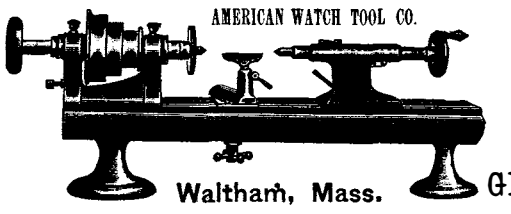

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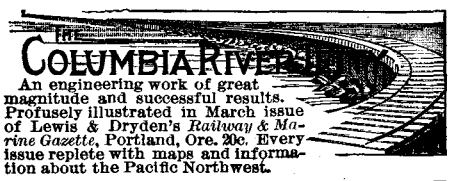
This Company also owns Letters Patent No. 463,569, granted to Emile Berliner, November 17, 1891, for a Combined Telegraph and Telephone; and controls Letters Patent No. 474,231, granted to Thomas A. Edison, May 3, 1892, for a Speaking Telegraph, which cover fundamental inventions and embrace all forms of microphone transmitters and of carbon telephones.



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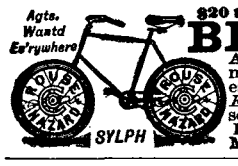

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